The Barnet Book of Photography

New Edition
(Illustrated)

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Preface

PREVIOUS editions of the Barnet Book of Photography have met with a most favourable reception, and it is hoped that this—the latest—will be equally popular.

With one exception (Pictorial Photography) all the articles have been specially written for this edition. They deal with many practical branches of photography, and their authors are recognised authorities on the subjects treated. No attempt has been made to reconcile slight differences of opinion occurring in one or two cases ; the reader is left to decide which advice best suits his own personal taste and requirements.

It is hoped that the Barnet Book in its new form will prove an attractive and valuable addition to the photographer's bookshelf.

W. L. F. W.

NEGATIVE MAKING.

BY

W. L. F. WASTELL, F.R.P.S.

(The production of the negative is obviously the foundation of photography, and an attempt is here made to assist in laying this foundation truly and surely).

IT is surprising how many photographers regard the production of a perfect negative as a matter of chance—as something worthy of gratitude (not unmixed with surprise), when it does occur. Others consider that only a small percentage of their negatives should be expected to require no "doctoring" afterwards. But there are some—although they are none too numerous—who can rely on the vast majority of their negatives attaining a high and even standard of technical excellence.

Naturally it is only the technical quality that is now under consideration; the question of selection of subject and its composition and lighting is another thing altogether. The purpose of this chapter may be stated thus: When a photographer decides to expose a plate, how can he make reasonably sure that the finished negative will be as nearly perfect for his requirements as possible.

No greater mistake can be made than to conclude that negative making is a sort of lottery, with few prizes and many blanks. There is no justification whatever for such a view. It would be just as reasonable for a skilled cabinet-maker to expect

only an occasional joint to be a perfect fit, and that all others should be tinkered, if possible, into some sort of passableness. The fact is that with the careful and methodical photographer the good negative is the rule, and the poor one the rare exception; and he seldom experiences the chagrin of knowing that he has missed a good subject by slipshod craftsmanship.

Perhaps craftsmanship is the best word to apply to successful negative making, which involves carrying out a series of operations with knowledge and skill. Fortunately the necessary ability to do this is within reach of all who do not mind taking pains.

PRELIMINARY PRECAUTIONS.

It may be stated without fear of contradiction that attention to the *exposure* of the plate is the foundation of good negative making. But the chance of producing a perfect final result may hopelessly vanish through inattention to other points that arise before the actual exposure is made.

It is safe to assume that the plates in an unopened box are in faultless condition. In transferring the plates to the dark slides, or the sheaths, that perfection may be impaired. To begin with, the plates should be handled by the edges, so that the surface of the film is absolutely untouched. The loading must be done, too, in a safe light, so that there is no risk of fogging them. Many photographers load their slides, even when using ordinary plates, in perfect darkness; and with a little practice and methodical arrangement this is quite easy to do, as the plates are invariably packed

film to film so that there is no doubt as to which is the sensitive side. When a light is used it should be "safe" for the particular plates being loaded, and even then the work should be done as far from the light, and as quickly, as may be.

Next, care should be taken that both camera and slides are free from dust that could by any chance reach the surface of the plate. A negative with "pinholes" due to dust cannot be placed in the perfect class. And, of course, there must be no defect in the apparatus that will result in the plate being light-struck—a leaky slide, for example. Neither is there any excuse for sufficient reflected light in the interior of the camera to cause a general fogging of the plate.

There are two other causes of flatness and fogginess in a negative that are frequently overlooked. The first is the dulling of the lens surfaces by dust, dirt or condensed moisture. The second is neglecting to protect the front surface of the lens by a hood, especially when working in sunshine and "against the light."

All these things must receive watchful attention, or the plate is foredoomed to imperfection, if not to complete failure.

THE CHOICE OF A PLATE.

IT stands to reason that the production of perfect negatives involves the use of a plate best suited to the particular work in hand. There is nothing in the whole range of photographic work for which a suitable Barnet plate cannot be found. Once a plate is selected it should be used until its working and capabilities are fully understood, for

it is a great mistake to fly from one brand of plate to another. It may be taken for granted that any brand of Barnet plate will answer its purpose to perfection if it is properly handled.

When high-speed work is undertaken, such as the photography of rapidly-moving objects, a very fast plate is essential—one that even with a minimum exposure will give full detail and gradation. The "Red Seal" plate fulfils these conditions.

For general hand-camera work in which the exposures are more generous, the "Red Diamond" plate works admirably. It possesses considerable latitude in exposure, and develops with that clean fogless character usually associated with much slower plates. The "Super-speed" or the "Extra-rapid Ortho" plates are also admirably suited for hand-camera work, and their rapidity is such that a light colour-filter can be used on many subjects, even with fairly short shutter exposures. The difference in the rendering of open landscapes, and subjects in which the sky plays an important part, is most marked when these ortho plates are used with a light filter, as compared with a corresponding rendering on an ordinary plate.

This brings forward the fact that the ideal negative must adequately render the proper colour values of the subject. No negative can be considered even passably satisfactory that gives prints in which blues are represented as white, and yellows and greens tend towards black. So that the photographer whose work is mainly landscape or still life (especially flowers), should select the "Medium Ortho" plate, and use with it the four times Barnet screen. In fact in all work where

full exposures can be given by employing a stand camera an ortho plate and a screen will give the best and truest renderings.

When full exposures can be conveniently given upon subjects with no awkward colour contrasts the "Medium" plate will do all that is required, and produce negatives of splendid quality. For making transparencies, as in enlarged negative production where a long scale of gradation is required, the "Ordinary" plate meets all requirements For the copying of black and white line subjects, or old, faded, or "flat" prints, where a short steep scale is required, the "Process" plate should be adopted.

A plate of a different and distinct character is the "Self-screen." This is a colour-corrected plate so treated that it requires no separate screen or colour filter used on the lens. It is used just as an ordinary plate of the same speed; but it must be remembered that a very full exposure is necessary to secure the advantage in colour rendering that it is intended to give. It may be stated as a general rule that in all colour-corrected plates, whether used with a screen or without, anything approaching under-exposure must be carefully avoided. The idea of all such plates is to give the less actinic rays time to take effect while the more active ones are held back.

The point is, then, first to consider the kind of work to be undertaken, and then to select that plate most adapted to its proper execution.

The backing of a plate also plays an important part in the quality of the negative. If possible, backed plates should always be used. The backing is never a disadvantage, and in an enormous number

of cases it adds immensely to the clean and sharp rendering of the subject.

EXPOSURE.

AS far as the technical quality of the negative is concerned it depends more upon exposure than upon anything else. Once the exposure is made the fate of the negative is sealed, inasmuch as the greater the error in exposure the farther will the result be removed from the ideal negative. It is a fatal mistake to suppose that gross errors in exposure are of little importance, and that they can be counteracted by special development treatment, or by some form of post-development doctoring. It is much nearer the true state of affairs to say, take care of the exposure and the development will take care of itself.

It has already been pointed out that there are certain preliminary precautions to be taken to avoid faults and imperfections in the final result; also that the choice of a suitable plate for any given kind of work must be considered. Actual development may be reduced to a mechanical system in which nothing is left to speculation or chance. But all these precautions against possible failure are of no avail unless the outstanding factor of exposure is carefully studied. As a matter of fact it is inattention to this vital stage of the work that accounts for more failures in negative making than from all other mistakes put together.

Strange as it may seem, the idea is by no means uncommon that high shutter speeds are an advantage, and that by employing these it is easy to secure good results in any circumstances and under

all conditions. Some workers, too, rely on a shutter which will give only one mechanical speed, and do not realize that there are any limitations to its efficacy. Others, again, alter the aperture of the lens without the slightest idea that this proceeding has any effect on the duration of the exposure if it is to be anything like correct.

Such haphazard methods would result in practically universal failure but for the fact that there is a certain range of latitude within the limits of which a greater or less degree of success can be secured. This latitude is sometimes very considerable, but in other circumstances is extremely small. The mistake frequently made is to rely on this latitude for possible successes. The wiser plan is to use every possible means of ascertaining the appropriate exposure in any given case, and then the said latitude will generally be more than sufficient to compensate for any miscalculation that may, and sometimes must, be made. There are many factors upon which exposure depends; in a sense the problem is a highly complex one, but inasmuch as practically all the factors can be definitely and accurately determined all that is required is, first, a knowledge of the factors, and, secondly, a method of determining them.

The light action given to the sensitive emulsion of the plate by exposure has one object to accomplish—to produce as accurately as possible in the negative the necessary gradations of tone or density required for the desired rendering of the subject. These tones are secured by the reduction to a metallic state of the silver salts in the emulsion by means of development; and this process takes

place in proportion to the light-action. If, for example, the exposure has been too short to allow sufficient light-action to impress itself from the shadow portions of the subject, no amount or kind of development will properly remedy the defect, and the negative will be once for all unsatisfactory. On the other hand, serious over-exposure will result in a loss of gradation in the brighter parts of the subject. Somewhere between the two lies an exposure that will give a result as nearly perfect as possible, and it is to arrive at this that consideration and calculation of the various exposure factors are essential.

Allowing exposure to depend on blind chance may be at once ruled out as hopeless; the result is almost universal failure as regards the production of perfect negatives. Perseverance may lead in time to acquiring slowly a sort of intuition that will considerably reduce the number of failures, but which is liable to break down, especially in unusual or unfamiliar circumstances. More reliable is the use of a guide in the form of an exposure table; best of all is the employment of a meter or actinometer. In the last case the actual *photographic* value of the light can be measured with sufficient accuracy; other calculations can be rapidly made by methods based on the principle of the slide rule; and the only factor demanding a personal estimate is the character of the subject.

Leaving out of consideration for the moment the question of movement in the subject, the factors governing exposure may be stated thus:—

(*a*) The actinic value of the light, depending on time of year, hour of the day, latitude, altitude, weather and other atmospheric conditions. As has

been said, some guide in this direction may be obtained from tables compiled for the purpose; but it is more simply and correctly estimated by finding the time taken to darken a piece of sensitive paper to a given standard tint.

(*b*) The speed, or rapidity, of the plate. The comparative speeds of the Barnet plates are given so that they can be taken into account whatever method is used for calculating the exposure.

(*c*) The stop, aperture, or diaphragm of the lens. Here again the necessary allowance can be calculated quite automatically.

(*d*) The character of the subject photographed. The variation due to this factor is enormous, but the subjects can be readily classified into a few groups with sufficient accuracy for practical purposes.

Further attention may be given to some of the details of these factors.

In determining the value of the light, actual test with an actinometer is by far the best method. The test should be made in such a manner as to measure as nearly as possible the light falling upon the darker parts of the subject. This suggests the old and well-founded advice to expose for the shadows. The aim of the exposure should be to give sufficient time for all the detail desired in the shadow portions of the subject to record itself adequately upon the plate. This must not, of course, be overdone. The exposure should be so timed as to render these darker tones faithfully as they appear, duly subdued and in proper relation to the other tones of the subject. A negative so made as to show just the right amount of transparency and luminosity in the shadows will almost certainly be

good everywhere else as well, provided development has been properly carried out, as will be described later.

Some workers modify their method of measuring the light by taking two readings—one for the shadows, and the other for the brightest illumination. They then calculate their exposure somewhere between the two. If this is done, care should be taken to keep the exposure near the shadow reading, so that it may be not reduced below a safe minimum.

As regards the variation in exposure due to the varying speeds of the Barnet plates, the following table may be used as a guide. It gives the numbers that may be read for tables or meters using respectively the H. & D. (Hurter & Driffield), Wynne, Watkins, and Burroughs Wellcome speed numbers. When the exact figure is not given in the table or on the meter it is sufficient to take the nearest, but this should be done preferably in the direction of the slower rather than the higher speed. In fact in all cases of compromise it is well to ensure full exposure and guard against under-exposure.

Plate	H. & D.	Watkins.	Wynne.	Burroughs Wellcome.
Ultra Rapid	550	800	180	1/16
Red Seal	350	500	143	1/8
Special Rapid ...	225	330	118	1/4
Ordinary	100	145	76	1/2
Self-screen Ortho ...	300	440	134	1/6
Super-speed „ ...	400	590	156	1/8

With all of these plates there is a certain minimum below which the negative will suffer more or less from under-exposure. But above this there is

considerable latitude. That is to say, the exposure may be very largely increased and yet a good negative will result. The higher exposures will produce increased strength or density, thus prolonging the time of printing, but the gradations of tone in the print will remain quite satisfactory. As a general rule the slower the plate the greater is this latitude in exposure.

The rule for deciding the alteration in exposure necessitated by varying the stop is well known. Taking the standard sizes of the stops the general rule is to double the exposure every time the next smaller stop is used. Thus, if the calculated exposure for *f*/8 is represented by 1, the relative exposure for other stops generally employed is as follows :—

f/4	*f*/5·6	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
¼	½	1	2	4	8	16

If any modification is made in applying this rule it is to keep the exposure on the generous side where very small stops are used.

It is in taking into account the type or character of the subject that a certain amount of judgment and discretion must be exercised. When the actinometer can be used to test the power of the light falling upon the worst illuminated parts the difficulty is largely overcome, but there are cases where allowances must be made. As a rule a sort of standard subject is presumed; and this is generally a landscape with no large, dark-coloured objects, or deep shadows, in the foreground. If the exposure for this normal subject, as it may be called, is

represented by 1, then a rough guide to exposure variation will be somewhat as follows :—

Clouds, sea and sky, distant panoramic views under bright and even light, 1/10th.

Snow-clad mountains in distance, seascapes with no vessels near at hand, open beach views, 1/5th.

Open landscapes, beach scenes with figures in mid-distance, yachts, lake and river views without dark foreground, ½.

Landscapes with strong foreground, streets partly in shadow, figures and groups at close quarters, 2.

Portraits out of doors in shade, dark buildings or heavy trees near at hand, 3.

Dark woods and badly-lighted interiors, 4+.

No hard and fast rules can be drawn in classifying subjects, and there is much inevitable overlapping. The chief thing that must be taken into account is the amount of dark or shadowed subject near the camera.

Interior views provide a wide range of problems in exposure, and the use of a meter is sometimes out of the question. If care be taken not to under-expose, the use of a set of good exposure tables will provide sufficient guidance. Plates with a good margin of latitude can be used in such cases, and then an exposure of an hour would give a satisfactory result when an equally good one could have been obtained in ten minutes. This is only given as an illustration of the fact that there is a wide range for successful exposures on such subjects, provided they do not fall below the minimum.

The same thing applies to work by artificial light, where the use of an actinometer is out of the question and when, from the very nature of things, only the roughest guide can be given by any data. Provided the exposure be not too short it may vary very considerably and yet give excellent results. Thus, if an exposure of ten minutes would give a good negative of a night subject so, doubtless, would half an hour. The extra twenty minutes seems a long time in itself, but the actual difference in exposure is only the same as giving half a second instead of one-sixth; and no photographer of experience would anticipate dire results in such a case as that.

There remains the case of exposures that depend upon movement in the subject, and not merely on the amount of light-action required to produce a properly exposed negative. As a rule general photography presents no great difficulties arising from movement, thanks to the high speed of plates and the large working aperture of lenses compared with those obtaining in the earlier days of the art. The waving of boughs in the breeze, the heaving of the sea, the movements of pedestrians and vehicles in the streets, are seldom sources of trouble. The rapidity of the plate, the aperture of the lens, and the speed of the shutter can generally be adjusted so as to secure adequate exposure on the one hand, and freedom from blurring due to movement on the other.

But there is a special class of work in which extremely rapid exposures are imperative. In this work special practice and experience are necessary, and the thing aimed at is the avoidance of failure due to insufficient allowance for the rate of move-

ment. Tables of exposures required for various objects in motion are of little practical use. The exposure depends not only on the rate of movement of the object as a whole, but upon that of its parts ; upon the direction of movement ; upon the distance of the object ; and upon the focal length of the lens. The photographer who specializes in this direction must work out his own salvation. His first step must be to ascertain by experiment the maximum exposure he can safely give to his particular class of subject without showing evidence of movement. He must then do all in his power to bring this exposure within the limits of sufficiency by using a fast plate and a large aperture. But even in such work the actinometer is a valuable aid. By indicating the correct exposure for a properly exposed plate it will help him to decide whether he can approach it sufficiently nearly to avoid hopeless failure.

There are exceptional cases in which some departure may be made from the normal calculated exposure. One of these arises when it is desired to produce a so-called moonlight effect in sunshine, when the plate is deliberately under-exposed. Another occurs when it is intended to reduce the range of light and shade contrasts so as to produce a picture in a few light tones. This result can be secured by giving a full exposure which is followed by curtailed development.

But, as has been said, the usual object of the exposure is to reproduce as accurately as possible the whole range of tones present in the subject. To do this with anything like consistency implies a knowledge of all the factors governing exposure,

and suggests the necessity of using every available means of accurately estimating them. A certain amount of personal judgment and discretion is demanded, but a good deal of the necessary calculation can be made as simple and certain as the multiplication table. And it cannot be too firmly emphasized that reasonably correct exposure is the very root and foundation of good negative making.

DEVELOPMENT.

THERE is no other photographic process that has such a vast number of variations as the development of a plate. There are scores of different developing solutions, and several distinct ways of employing them. Yet at bottom the operation is a simple one. Essentially it resolves itself into applying to the exposed plate a solution which will reduce metallic silver in proportion to the light action, and so produce a negative with gradations of proper density. Given that the exposure has been correct within certain limits, development can be reduced to a mechanical operation with great exactness and uniformly good results.

It is just as well to discard once for all any idea of "tinkering" with the developer in the hope of thus being able to compensate for errors, real or fancied, in exposure. The best plan is to decide on one particular developer, and on a definite method of using it. Only by this means is any certain uniformity of results likely to follow; but this does not imply, by any means, that no variation in the results can be obtained. Once the method of development adopted is fully understood every

possible modification needed can be made with ease.

The most important point to be decided in development is the proper duration of the process in order to obtain a given result. Other things being equal, the longer the development the greater the strength or density of the negative; so that it is necessary to know just how far to carry the operation to obtain a negative of the strength desired. The time taken varies enormously in different circumstances, but can be found accurately in every separate case. This is one great reason for avoiding the use of many different developers, as the behaviour of some of them is very misleading to those unfamiliar with them. The proper course is to rely on one developer, so that its working may be fully understood and systematically applied.

The methods of development may be given under three heads—

(1) The observation method.

(2) The factorial method.

(3) The time and temperature method, with its modification known as tank development.

When the OBSERVATION method is used the progress of development is watched at intervals, and completion is judged by the appearance of the plate. When the same developer is used with the same brand of plate this method is successful in experienced hands. The decision as to when to cease development is generally arrived at by the appearance of the back, or glass side, of the plate, where the denser parts of the image are visible more or less markedly. With some kinds of plate this image must be quite pronounced; with others it should

be scarcely visible, and to some extent it is modified by the character of the subject.

In the FACTORIAL method the developer is applied to the plate, which is then carefully watched for the first signs of the appearance of the image. The time occupied is exactly noted, and is then multiplied by a certain number which gives the total time required for development. The plate is then covered and development continued till that time has elapsed. It is not particularly easy to detect the first appearance of the image, and the plate is unduly exposed to light while this is being watched for; and there must be some means of measuring both periods of time correctly.

There is a more serious objection to this method when exposure has been incorrect. The image on an under-exposed plate is slow in making its appearance; the multiplying factor then gives a long development period, and this prolonged development aggravates the inferior results due to the original error. An over-exposed plate, on the other hand, shows sudden and general darkening very quickly; the development period then works out as a very short one, and the plate as a result bears only a thin ghostly image.

The TIME AND TEMPERATURE method gives the best all-round average results. It is based on the fact that a given developer, at a given temperature, applied for a given time, produces the best average results, even when there have been errors one way or the other in exposure. For correctly exposed plates the time can be so adjusted as to produce perfect negatives of the exact density required. Under-exposed plates will be too thin, but in the

right condition to be improvable by intensification. Over-exposed plates will be dense, but may still give excellent gradation by more prolonged printing, or they may be reduced to quicker-printing quality.

More will be said presently of these methods of development, but it will be convenient first to consider the choice of a developer.

An excellent developer for all brands of Barnet plates, and one which has held its own for a long time, is pyro-soda.

A stock solution of pyro is made by first dissolving ¼ oz. potassium metabisulphite in 5 or 6 ozs. water, adding 1 oz. pyro, and then making up with water to exactly 8 ozs. This keeps well.

Working solution No. 1 is prepared by taking 2 ozs. stock pyro and making up to 20 ozs. with water. Working solution No. 2 consists of soda sulphite (crystals) 2 ozs., soda carbonate (crystals) 2 ozs., water to 20 ozs. When fresh these solutions give a clean image approximating to pure black, which may acquire a slight (and useful) tinge of colour during the subsequent washing. As the solutions get older there is a tendency to a greenish colour.

The developer may be used in equal parts, or in the ratio of one part of each and one part of water. In the latter case development is of course slower. Those who prefer the addition of potassium bromide may conveniently add what they consider desirable in the form of a 10 per cent. solution.

If the diluted form of the developer and a small quantity of bromide is used the following table may be consulted. It gives the number of minutes

for development of various plates at the temperatures specified :—

Temperature.	55°F.	60°F.	65°F.	70°F.
Special Rapid	7¼	6	5	4¼
Red Seal	6½	5½	4½	4
Self-Screen Ortho.. ..	10¼	9	7¼	6
Super-Speed Ortho ..	10¼	9	7¼	6

Now it may be found that with the plate, developer and temperature employed, the resulting negative is not quite what is desired. It is then easy to increase the time to secure greater density, or to reduce it to get a softer result. Obviously it is a simple matter to arrive at a suitable figure for any given set of facts—plate, developer, temperature, density.

Similarly, when the particular composition of the developer is decided upon it is easy to discover the significant appearance of the back of any of the brands of plates when the observation method is being employed. And again, it is only a matter of experiment to arrive at a satisfactory multiplying number for the particular plate in use when the factorial method is adopted. So that, working methodically, it is possible very quickly to arrive at data that will reduce the development of the plates to a mechanical certainty.

By way of preliminary experiment the factor 5 may be tried with the pyro-soda formula ; that is, the plate may be developed for a time equal to five times the period taken for the first appearance of any image. This may then be modified as seems desirable.

Another popular developer is metol-hydroquinone. The combination works well, as metol tends to give delicacy of detail, and hydroquinone density. It should not be used, of course, by those whose skin is affected by metol.

The following ingredients should be dissolved in the order and quantities given :—

Metol	¼ oz.	or	5 grams.
Hydroquinone...	¼ oz.		5 ,,
Soda sulphite (crystals) ...	3 ozs.		60 ,,
Soda carbonate (crystals) ...	3 ozs.		60 ,,
Potassium bromide	¼ oz.		0·5 ,,
Water	50 ozs.		1000 c.cs.

Warm, but not hot, water may be used in compounding this, but in that case the solution should not be used till cool. The bromide may be omitted ; this will somewhat decrease the time of development. With the formula as given the times of development that may be tried by way of experiment are as follows :—

Temperature.	55°F.	60°F.	65°F.	70°F.
Special Rapid	6½	5½	4¾	
Red Seal ..	6	5	4¼	
Self-Screen	9½	7½	6	
Super-Speed	9½	7½	6	5¾

As an experimental factor for this developer 14 may be tried.

It has been mentioned that " stand " or " tank " development is a form of the time and temperature method. The plates are placed in grooves in a light-proof tank where they are subjected to a prolonged development in a diluted solution. By this means many plates can be treated at once, and no attention

is necessary beyond, in some cases, an occasional inversion of the tank. It is not, in some respects, an ideal method, and backed plates cannot safely be subjected to it, but it is becoming increasingly popular.

If the metol-hydroquinone developer just given is diluted with three times its bulk of water, with the addition of one drop of 10 per cent. potassium bromide to each ounce of the total quantity, the time of development is suggested by the following :—

Temperature.	55°F.	60°F.	65°F.	70°F.
Special Rapid	37	33	27	23
Red Seal	36	30	25	21
Self-Screen	55	49	40	35
Super-Speed	55	49	40	35

Those who favour a single-solution developer may readily arrive at a series of times for any given plate, at the stated temperatures, for any of the development methods adopted.

For very high-speed work, where the exposure may be barely adequate even with a Red Seal or Super-Speed Ortho plate, a good developer to use is pyro-metol. Two solutions are made up thus :—

A.	Pyro	80 grs.	8 grams.
	Metol	70 grs.	7 ,,
	Potassium metabisulphite	180 grs.	18 ,,
	Potassium bromide (optional)	30 grs.	3 ,,
	Water to	20 ozs.	1000 c.cs.
B.	Soda carbonate	3 ozs.	100 grams.
	Water to	20 ozs.	1000 c.cs.

This may be used in equal parts, or diluted if preferred. The colour of the image is such as to make the most of the printing value of the details.

There are several other points in connection with development that demand attention.

Solutions compounded at home should be made up as accurately as possible, and with ingredients of the best quality. A sufficient quantity should be taken to obviate any risk of spoiling the plate by its being incompletely covered. The developer should flow entirely over the plate in an unbroken gentle wave. The dish should be gently rocked during development. After the developer has done its work it should be thrown away and the dish thoroughly rinsed. The dish must be kept clean, and used for no other purpose.

It is convenient to have plenty of safe light in the dark-room, but it must be remembered that the safest of lights is only comparatively harmless and will affect the plate sooner or later. The plate should not be exposed to the direct action of the light for a single second longer than is necessary. The dish should be kept as far from the light as possible, and covered while development is in progress. These precautions are specially necessary in the case of high-speed and orthochromatic plates. If the time method of development is employed the plate need not be exposed to the light at all. A good test as to whether due care has been taken in this respect is to examine the edges of the plate where they have been protected from light action during exposure. They should be quite free from fog. If they are not, the cause is either due to exposure to the dark-room light or to chemical fog in development.

The plates should be handled with the greatest

care, as the saturated film is most delicate and easily damaged.

When backed plates are used no attempt should be made to remove the backing before development. This would almost certainly result in water reaching the film side. The backing may be most conveniently cleaned off when development is complete, or even after fixing. The best method is to hold the plate horizontally, backing downwards, over a dish of water, and rub the under side with a sponge.

Flat films may be developed in the same way as plates, but roll films require special treatment. It is quite possible to hold a strip of film in the two hands, let it hang down in a festoon, and see-saw it backwards and forwards through a dish of clean water until it is evenly wetted and limp, and then continue the action through a dish of developer. This is a somewhat messy and tiring operation, and has the added disadvantage that the film is exposed to the dark-room light for a considerable time.

The best plan for developing roll film is to use one of the machines designed for the purpose. The film is wound into the machine without any exposure to light whatever, and, indeed, does not emerge until it is fixed. The system of development by time and temperature is, of course, used in this case.

FIXING.

AS soon as development is complete the plate should be rinsed for about half a minute or less, and placed in the fixing bath. The term " fixing " is rather a misnomer in this connection—" clearing " would be a more expressive term. Only a certain portion of the silver salts in the emulsion has been reduced to the metallic state; the rest is still sensitive to light, and it is this that must be completely removed if the negative is to remain unaltered.

For this purpose a solution of hyposulphite of soda, commonly known as "hypo," is almost invariably used. It is not a good plan, although a common one, to make up this bath as wanted; the dissolving of the crystals causes a great fall in temperature, and the bath then works slowly and may cause trouble with the gelatine film. The better way is to make up a quantity at once and keep it as a stock solution. A suitable strength is:

Hypo	½ lb.	or	200 grams.
Water	40 ozs.		1000 c.cs.

To this may be added 1 oz. potassium metabisulphite which converts what was previously a neutral solution into an acid one.

Unfortunately, many photographers use their fixing bath until it is so muddy and discoloured that it begins to stain the negatives, when they decide that it is time to discard it. The addition of the metabisulphite keeps the bath clear for much longer, and so helps to disguise the fact that the bath is exhausted. Hypo solution is so ridiculously cheap that there is not even the excuse of economy

in overworking it, and by so doing the permanence of the negative is seriously jeopardized. A given quantity of hypo solution will only do its work thoroughly with a certain number of plates, and the wise course is to take fresh solution for each batch of plates and throw it away when done with.

Another important point is to make sure that fixation is complete, and this cannot be judged by mere observation. The creamy emulsion remaining in the developed plate gradually disappears in the fixing bath, until there is no sign of it on examining the glass side of the plate. But at this stage the operation is by no means complete. A salt has been formed that is insoluble in water, and consequently it will remain in the film throughout the washing, with disastrous after effects. If the plate is left in the bath this salt, in the presence of an excess of hypo, is further changed to a salt that is soluble in water, and will therefore be completely removed during washing.

The general rule laid down is to keep the plate in the hypo for twice as long as it took to become visually clear. This should be regarded as the minimum time, and exceeding it will do no harm. More trouble in the form of deteriorated negatives is caused by incomplete fixation than by imperfect washing.

The plate should not be exposed to actinic light till fixation is complete. Even if no stain is caused at the time by so doing trouble may arise later, especially in the case of some forms of intensification being subsequently employed. The dish should be occasionally rocked during fixation, and the

fixed plate should not be exposed to the air for long before washing.

As fixing takes some time as compared with development it is an advantage to have a grooved tank, rather than a dish, for the operation. There is then no temptation to remove a plate too soon to make way for another. But in this case, too, care must be taken not to overwork even the large amount of solution then employed.

WASHING AND DRYING.

IT has been said that a negative should have an image of pure silver in clean gelatine. To secure this a thorough washing is now necessary to remove the hypo and the salts into which it has converted the unreduced silver.

There is a pretty general idea that running water is essential to complete and rapid washing, and even that the cleansing process is complete provided a certain quantity of water is rushed through the tank. As a matter of fact even the most effective method of washing requires a certain minimum of time, and this cannot be reduced by any means at present known. In attempting to expedite matters recourse is sometimes had to so-called hypo-eliminators. Probably all that these accomplish is to convert the substances that should be removed into other substances of doubtful composition which remain in the film. The best eliminator for hypo is water, applied in a proper manner.

An excellent method of washing plates is to place them in a grooved rack in a tank of water.

COMBINATION PRINT WITH BORDER TINTS. SHIP INTRODUCED FROM SEPARATE NEGATIVE

(W. L. F. Wastell)

Every five minutes the rack is lifted out and drained, the tank completely emptied, refilled, and the rack returned to its place. A dozen such changes will remove from the film everything that is removable. The rack and tank should be so constructed that there is a considerable depth of water below the bottom edge of the plates. As the hypo slowly leaves the film it sinks, and it is for this reason that a syphon tank is useful, as clean water enters at the top while the contaminated water is constantly drawn off from the bottom

When washing is complete it will not do simply to lift out the rack of plates and stand them to dry. The plates are too close together, and will dry so irregularly and slowly that there is serious risk of drying-marks and even of decomposition of the wet gelatine

The negatives should be taken singly, held in a gentle stream of water from the tap, and the film immediately wiped with a plug of cotton wool. The film should then be wiped with a smooth, damp pad of wash-leather, rubbing gently from the middle towards the edges. This will remove the [illegible] moisture and promote rapid and even drying. The plates may then be stood on edge along a shelf, where the air has free access to the film, and allowed to dry spontaneously. No attempt should ever be made to expedite the drying of a partially dried negative.

A dry negative should present a perfectly clean, silky film surface, and the glass side should be thoroughly polished.

The drying of negatives may be considerably hastened in several ways. They may be placed in

methylated spirit for five minutes, or they may be treated with formalin and dried by heat. But it is not advisable to resort to any such means, except in the case of negatives from which prints are urgently required as quickly as possible.

The film of a finished negative is easily susceptible to damage, especially by scratching. It is, therefore, necessary to provide means of safe storage. One of the best systems is to have a number of boxes in which each negative is placed in an envelope, with arrangements for recording useful data and indexing.

Varnishing is an additional protection to negatives, particularly against staining. Spirit varnishes should not be used for films A good cold varnish for plates is :—

Celluloid	1 oz.	or	10 grams.
Amyl acetate	50 ozs		500 c cs.

This may either be flowed over the plate in the usual way or applied with a brush.

INTENSIFICATION AND REDUCTION.

A NEGATIVE which emerges triumphantly from the series of operations performed upon it, and exhibits fine definition and detail, and perfect gradation and tone values, is a beautiful object in itself. Better still, it will render fine prints, enlargements or lantern slides. But even with the most scrupulous care it is not all negatives that attain perfection.

The probability is that the great majority of the remainder are susceptible of more or less improve-

ment. Amongst the many things that can be done in this direction the processes of intensification and reduction take an important place. A negative that requires either treatment may never be quite as good as it might have been, but it can probably be made very much better than it is.

Negatives that suggest intensification are generally those whose development has not been carried far enough to produce sufficient density. They are too thin. If they are clean and unfogged, and possess detail and a reasonable amount of gradation, the scale of densities may be raised with advantage. There are many ways of doing this, but perhaps the best all-round method is that of bleaching and re-developing. One good point about it is that if the effect of the first treatment is found to be insufficient the process can be repeated, with an added gain in intensity. Another recommendation is that the result is permanent. This cannot be said to be the case in some of the methods involving the use of mercury, especially when there is any error or carelessness in the operations involved.

A bleaching solution may be made up from stock solutions or otherwise in the following proportions :

Potassium bichromate	50 grs.
Hydrochloric acid	25 minims.
Water	5 ozs.

This solution will not keep. The plate should be thoroughly soaked, and the solution applied till the image is completely bleached. It is then well washed to remove the bichromate stain, and after exposure to daylight is re-developed fully. The best developer for the purpose is not pyro, even if that were the original developer used, but amidol,

metol-hydroquinone or other clean-working solution of these types. The plate is then washed and dried. It is necessary to dry the plate before the degree of intensification can be judged, and as has been said, the process can be repeated if required.

Although this chromium intensifier will be found suitable for all cases, there is no single form of reducer that is equally universal in its application. The reason is that there are three separate and distinct cases in which reduction may be deemed advisable, and each one demands treatment to suit it. These three cases are :

(*a*) Probably by reason of over-development the negative is too strong everywhere, so that it prints slowly by any process, and is quite unsuitable as it stands for certain purposes, such as enlarging. What is required here is a solution that will work on the whole image so as to carry it back to what it would have been if the developing process had not been overdone. The relative gradations must remain unaltered.

(*b*) There is a general fogging or veiling of the plate ; the shadows are not clear. This requires a reducer that will first attack this fog.

(*c*) The gradations are good except in the high-lights, which are so dense and blocked up that detail and half-tone are lost in those parts. This calls for a treatment that will considerably reduce this excessive density without at the same time attacking the delicate detail in the shadow portions.

Case (*a*) is effectively dealt with by means of an acid-permanganate bath. A stock solution of potassium permanganate is prepared by placing 40 ozs. of water in a bottle, and suspending just below the

surface for twenty-four hours a muslin bag containing 50 grs. of the permanganate. The bag is then removed. The object of making up the solution in this way is to guard against the possibility of undissolved particles in the solution.

The working solution is made up thus :—

Stock permanganate	..	5 ozs		250 c.cs.
Water	... . . .	10 ozs.	or	500 ,,
Sulphuric acid	... ..	20 minims		2 ,,

The well-soaked negative should be placed in a white porcelain dish, as it is necessary to watch the colour of the solution, which should be poured away as soon as it loses its bright clear appearance, and a fresh quantity applied. The progress of the reduction should be keenly watched so as to avoid carrying it far enough to affect the shadow details too much. The plate is then just rinsed and placed for five minutes in a 2 per cent. solution of oxalic acid. This prevents any likelihood of stain. The plate must not be soaked or washed in running water, but just changed into clean, still water two or three times. When dry it will have all its original gradations without inconvenient density.

Case (*b*) is best dealt with by means of Howard Farmer's reducer. To prepare this it is convenient to keep a 10 per cent. solution of potassium ferricyanide (strong poison). Some of the acid hypo bath previously mentioned is taken and diluted to half strength ; it must be unused solution. To this is added enough of the ferricyanide solution to produce a pale sherry colour. The amount of ferricyanide is not important ; the stronger it is the more rapidly it acts, but it is wise to keep it

fairly weak so that the operation is more under control and can be carefully watched.

The plate should have been washed after its ordinary fixing. If it has been also dried it must be thoroughly soaked. It is flooded with the reducer, which must be kept well on the move. As soon as the shadows are seen to have cleared, or rather a little sooner, the plate is withdrawn and quickly rinsed, and afterwards well washed. The thing to guard against is loss of the light shadow detail.

Case (*c*) should be treated chemically with Bennett's formula, which, although making use of the peculiar action of ammonium persulphate, is more reliable than when a simple solution of that salt alone is used.

The stock solution is :—

Ammonium persulphate ...	1 oz.	or	10 grams.
Sodium sulphite	85 grs.		2 ,,
Sulphuric acid	45 min.		1 c.c.
Water up to	$9\frac{1}{2}$ ozs.		100 c.cs.

For use this is diluted with from 4 to 8 parts of water. The negative must have been thoroughly washed. As the solution begins to do its work it becomes opalescent, and when this is very marked it should be poured off and a fresh dose applied.

If treatment is continued long enough every tone in the negative will be reduced; but the peculiarity about this reducer is that it attacks the densest parts first. It begins at the opposite end of the scale of gradation to what the Howard Farmer reducer does. As soon, therefore, as the undue density of the high-lights has been sufficiently modified, the plate should be rapidly rinsed, and placed for not more than five or six minutes in a

fresh acid fixing bath. It is then fully washed as usual.

Case (*c*) can also be dealt with mechanically by means of Baskett's reducer. Of course, the persulphate reducer attacks all the areas of great density indiscriminately, but with mechanical reduction the action may be selective. The preparation contains the following ingredients :—

Terebene	2 ozs	or	10 c.cs.
Olive oil	2 ozs.	or	10 „
One 2d. tin "Globe" polish.			

The ordinary terebene of the oil shop is good enough. The components are thoroughly mixed, and strained through muslin two or three times. The mixture will keep indefinitely in a well-corked bottle, but must be thoroughly shaken before use.

A little is placed on an old linen handkerchief, or a piece of chamois leather, over the finger tip, and the dense patch rubbed with a rotary motion. Too much force will damage the film, but gentle rubbing will soon remove some of the metallic silver, as evidenced by the blackening of the rubber. No attempt need be made to keep the action within the boundaries of the dense area, as the lighter detail adjoining will be unaffected.

When the density has been sufficiently reduced the film should be cleaned with benzene or alcohol to remove all grease.

Clearing.

It sometimes occurs that a negative—either through development or discoloration of the fixing bath—yields a yellow stain which it is necessary to remove before satisfactory prints can be obtained.

The stain may be removed by immersion in the following bath :—

Alum	2 ozs.	}	or	200 grams
Citric acid	1 oz.	}	or	100 grams.
Water	10 ,,	}	or	1000 c cs

Another clearing bath which is found to be very effective especially when the stain is very intense, is as follows :—

Thio-carbamide	90 grains	}	or	10 grams
Citric acid	90 grains	}	or	10 grams
Water	20 oz	}	or	1000 c cs

It is essential that the negative be very thoroughly washed before applying this bath.

OTHER MODIFICATIONS.

THERE are further means of modifying the printing value of negatives and otherwise improving them. Even when a negative is technically excellent, and a faithful tone record of the subject, there may be artistic reasons for controlling its printing values.

A good deal may be done in this direction by coating the glass side of the negative with matte varnish. When dry this may be removed in parts by scraping away with a penknife. The effect will then be to slow down slightly the printing value of those parts over which the coating remains. The action will be much more pronounced if the varnish is stained yellow or red, but in such a case the effect is far too exaggerated for gaslight or bromide work, and is only suitable for daylight. High-lights may be accentuated by working on the varnish with pencil, or larger areas lightened by applying blacklead with a stump.

Similar work may be done by substituting papier minerale for the matte varnish. A piece of the

paper slightly larger than the plate is damped, a thin line of adhesive run round the edges of the glass side, and the plate laid down on the paper, which is then gently rubbed into close contact round the edges. When dry the paper will be tightly stretched. It is then susceptible of easy treatment with crayon and pencil, and pieces may be cut away with a sharp penknife where full printing value is desired.

Whether varnish or paper is used it is advisable on completion of the work to protect it from damage. This is done by laying over it a clean negative glass, and binding the two plates together round the edges in the manner of a lantern slide.

"Pinholes" in the dense parts of a negative may be blocked up by a gentle touch with the point of a crow-quill pen dipped in India ink. They will then appear as white spots on the print and must be treated by "spotting" the print itself.

Retouching the negative is a small art in itself, and, especially when combined with the use of the knife, demands considerable skill and practice. But successful treatment of small defects, such as little clear patches that require lightening (in the print), may be undertaken even by beginners. All that is required is the knowledge of the proper way to apply a trace of retouching medium, and the subsequent use of the pencil. This knack is also useful when it is required to block out part of a negative completely, such as a sky. The best way is to retouch a narrow line following the outline of the parts to remain, and then painting close up to this with an opaque medium, rather than painting right up to the outline itself. This avoids the hard,

cut-out appearance that is so fatal to a good result.

CONCLUSION.

A GOOD deal has been said about the after-treatment of negatives, because it is quite necessary that the photographer should know what means are available in this direction, and be able to take full advantage of them. At the same time it must be remembered that every effort should be made to produce just the negative that is required by direct means, so that if any subsequent modification is necessary it should be reduced to a minimum.

The precautions to be taken precedent to exposure should be borne in mind. Then the most elaborate care and attention should be bestowed on the all-important question of exposure. Next, a proper and well-defined system of development should be adopted. Finally, all the necessary operations should be carried out with scrupulous care, avoiding haste and paying great attention to cleanliness. Nothing short of a perfect result should be accepted as satisfactory.

By these means it is possible for every earnest photographer quickly to master the art of negative-making, and to produce from his exposures a large proportion of what may fairly be called perfect negatives, at any rate from the technical point of view.

It is impossible to define a perfect negative. The question must be begged by saying that it is the one most suited for its particular purpose. The ideal negative for reproducing a line drawing in black on white presents a design of clear glass in a surround of the greatest density the plate will

give. A negative of a landscape or architectural subject will almost certainly contain neither of these extremes to a perceptible extent, but will be characterized by a long and complete scale of gradations of tone densities.

As a rule the ideal negative in general work is one that will give a finely graduated print by enlargement. Such a negative will probably also do anything else that may be required of it. There is less need than formerly for making the negative to suit the process. The tendency of late years has been in the opposite direction—to suit the printing process to the negative. Papers are specially devised for giving strong prints from thin negatives, or soft prints from contrasty ones.

The worker who uses carbon as his usual printing medium can easily learn to produce negatives of the exact quality to suit his process; but if he makes them unduly strong he will disqualify them for producing softly graduated enlargements on bromide paper. He can preserve them as suitable for this latter purpose also simply by sensitizing his carbon tissue to suit the somewhat thinner negatives.

Similarly if he desires diffusion in his prints he need not produce it by throwing his negatives out of focus. So doing will deprive him, for example, of the possibility of making a sharp lantern slide. He may well retain definition in the negative and suppress it to any extent in the print.

At any rate a negative should be an example of perfect craftsmanship—clean and pure, and free from flaw or blemish of any kind. No amount of trouble and care should be considered too great to secure such a desirable end.

ORTHOCHROMATIC PLATES AND FILTERS.

By

G. T. HARRIS.

(No photographer can afford to ignore the advantage, and in many cases the absolute necessity, of the use of Orthochromatic Plates, with or without Filters. Mr. G. T. Harris gives here some useful information on the subject.)

IT probably does not occur to the photographic worker of the present day when he loads his dark slides with the almost faultlessly perfect product that the "ortho" plate has become, that it is the result, not of a recent invention, perfected in the course of a few months' laboratory work, and placed upon the market in its present highly efficient and perfect state; so reliable in every way that no doubt whatever exists in the photographer's mind as to the plate's capability of yielding perfect negatives. The orthochromatic plate of to-day is the result of over forty years of continuous and painstaking research and experiment. Passing over a vast amount of work by early physicists in improving the sensitiveness of the photographic plate to the various regions of the spectrum, it will be sufficient to date the genesis of orthochromatic photography from H. W. Vogel's discovery of sensitising silver bromide to the yellows and reds

of the spectrum by adding a solution of eosin to the collodion used in the preparation of the plates. This addition gave to the sensitive silver salt an increased sensitiveness to the yellows, greens and reds, though even with the additional sensitising action of the eosin dye the plate still remained superlatively sensitive to the blues and violets of the spectrum. It was not until the introduction of the yellow filter that the great value of the additional sensitising became apparent, and this introduction, let it be observed, was made quite early in the history of orthochromatic photography.

H. W. Vogel's method of increasing the sensitiveness of silver bromide to the less refrangible rays of the spectrum pre-dated but a short time the introduction of dry plates into general use; that is to say, photographers were tentatively trying the capabilities and qualities of the, then, new dry plate alongside the trusted and familiar wet collodion plate. And it follows that when the dry plate established itself in popular favour and became a reliable and efficient instrument, the discovery of Vogel should be applied to the process that had superseded the wet plate. Hence we find that the two processes, representing more truly than any other the corner stone of modern photography, orthochromatism on the one hand and gelatine bromide emulsion on the other (born curiously enough in or about the same year, 1873), had by the year 1887 appeared on the photographic market as an orthochromatic dryplate. But, as may be imagined, not the highly sensitive, reliable and scientific plate that leaves the laboratories of our plate manufacturers in the present day. At the same

time it must be said that it was an immense step forward had photographers generally known how to avail themselves of it, but as has been said the principles underlying colour-sensitive photography were not understood by those for whom the plate was made. The filter was ignored and colour sensitive plates pronounced practically no advance for average work over the ordinary plate.

It is a commonplace of knowledge in these days that white light when examined by a spectroscope is seen to consist of a series of spectrum colours, violet, blue, green, yellow, red and numerous gradations. Of these the sensitive silver halide used in the making of a gelatine plate shows itself most influenced by the violet and blue, becoming much less influenced as the yellow and orange region of the spectrum is approached. This means that in a print the yellows and orange would be rendered much darker than the blues and violets. Now this is unfortunate, as it is the exact inverse of the mental conception of colour, which conceives of yellow as much lighter than blue; so that an engraver translating an artist's colour picture into monochrome would engrave his plate so that the yellows in the picture might in his plate take less ink than the blues, and thus appear in the print much lighter. To obviate this defect in the silver halide, that is, to increase the sensitiveness towards the greens, yellows, and reds, is the object of dyeing the emulsion with some dyes capable of effecting this. It might be thought that once this was effected the matter was at once re-adjusted, but in spite of the extra colour sensitiveness conferred by the dye, so sensitive to the violet and blue is the

silver salt that the translation is still untrue, the violet continues to act more rapidly than the other regions of the spectrum. To set this matter right it is necessary to remove some of this violet from that portion of daylight constituting the camera image by interposing a yellow screen and filtering out some of the violet before it reaches the sensitive plate. In adjusting this colour filter to the plate, and filtering out precise and known regions of the spectrum, an enormous amount of experimental, patient and painstaking work has been expended. It might be thought that any filter so long as it was yellow would suffice. This was the mistake of early workers in orthochromatic photography; their filters were an unknown quantity, either they filtered out too much blue or they left too much violet still in; the result being, in the one case over-correction, and in the other under-correction. That is to say, in the one the blues and violets were too dark in the resulting print, while the greens and yellows were too light, the reverse happening in the other case.

Modern orthochromatic photography is a matter of scientific measurement; the plate maker knows to what portion of the spectrum his plate is sensitive, he further knows what portions of the spectrum it is desirable to lower in activity by means of a filter, and he constructs filters to lower just the portions his plate needs. Hence no guess work exists in translating colour into monochrome. For this reason it is always advisable for the photographic worker, when choosing an orthochromatic plate of some particular make, to use with it the platemaker's filter, as it may be inferred that the

manufacturer knows best what adjustment between plate and filter is necessary. From what has been said it may be thought that an ordinary undyed emulsion is sensitive only to the violet and blue region of the spectrum, and that it would be unaffected by rays of less refrangibility, *i.e.* yellow and orange. This is not altogether the case, however, as by a prolonged exposure to these rays the plate would ultimately show a developable result; if it were not so it would be unnecessary to exercise any care with regard to the dark-room light. It is important that this fact should be clearly recognised, as then the importance of not subjecting photographic plates unduly long to the action of a dark-room light will be appreciated. From what has been said on the subject of conferring additional colour sensitiveness on the emulsion by the aid of dyes it will be obvious that if an ordinary plate is ultimately affected by dark-room light, an orthochromatic plate, being so sensitive to colour, can only be safe when handled with the greatest circumspection in the dark-room. With a rapid orthochromatic plate of modern manufacture a distinct veil of fog will be produced by exposing it to the ordinary dark-room window for a few minutes while it is in the developing tray; hence photographic workers who desire clean, bright negatives must see to it that their non-actinic light and method of development are such as will securely protect the plate, both when loading the slides and during development. On account of the great photographic energy of day-light, even when filtered through several thicknesses of apparently safe ruby media, it is better to light the dark-room entirely

ORTHOCHROMATIC PHOTOGRAPHY (*See p.* 47)
(*G. T. Harris*)

by artificial light, and use a good non-actinic lamp for plate-changing and developing operations.

The manipulation of red-sensitive or "Panchromatic" plates is generally carried out in absolute darkness, or with filters specially designed for the purpose, and even then only with the greatest precaution, the modern panchromatic plates being extremely sensitive to all colours.

The radical change that has taken place in late years in the methods of developing photographic plates has been altogether in favour of the orthochromatic plate, as they have contributed to securing greater safety from light action during the process. The old method of holding the plate in a tray during development, exposed for, perhaps, ten minutes to a ruby light of questionable safety a couple of feet distant is more or less a thing of the past. The modern worker knows that if he concentrates his efforts on securing as near as possible a correct exposure the development of the plate is largely automatic. For this reason users of orthochromatic plates should expend considerable pains in acquiring the habit of carefully regulating their exposures. Broad lines can be laid down and followed which, combined with the latitude existing in the high-class modern plate, will reduce development to a very simple operation. Plate makers now give the speed of their plates to various actinometers on the markets and if an intelligent use is made of the two failure in exposure is the exception. The maker's formula for development should be adopted unless the worker has good reasons for preferring some other, for it can always be relied upon to suit the plate and give the best results

with it, which a formula chosen by inexperienced hands may not do.

It should be mentioned that the temperature of the solution has an important effect on the development of the plate. If the developing solution is low in temperature, development of the plate is greatly delayed and an appearance of under-exposure given to the plate; too high a temperature on the other hand causes rapid development and an appearance of flatness and over-exposure in the negative. Hence a watchful eye has to be kept in winter to see that the developer reaches a temperature of 60°F. or thereabouts, and that in summer it does not exceed 65°F.

Much discussion in photographic circles has taken place on the relative merits of the acid and the plain fixing bath, and as a constant user of the former for a number of years I feel bound to add my testimony in its favour, especially with regard to its use by the amateur photographer who develops a few plates at infrequent intervals. It keeps perfectly clear and produces stainless negatives, unlike the plain fixing bath, which gradually discolours when even one or two plates have been fixed in it if placed on one side to be used subsequently, and which stain is imparted to negatives afterwards fixed in it. No one, probably, would think of using a plain solution of hyposulphite for fixing bromide prints, and the negative is equally deserving of a stainless solution. The acid fixing bath contributes materially to completely discharging the dye used in orthochromatising plates, and which, of course, is no longer required when the

plate has been developed. The photographer who desires permanence for his negatives will pay the same attention to the use and conservation of his fixing bath as is bestowed on previous operations. To ensure thorough fixation two baths may with advantage be employed, the plate being placed in the first and left until the yellow appearance caused by the silver halide has disappeared, when it may be placed in the second for five or ten minutes. Overworking the fixing baths has to be carefully avoided if permanence is sought for, and when a fixing bath shows signs of working slowly it should either be discarded or used as a second bath. Formulæ for acid fixing baths vary considerably in composition, but the following is very simple and efficient.

Sodium hyposulphite ...	4 ounces	or	200 grams.
Potassium metabisulphite ..	½ ounce		25 ,,
Water	20 ounces		1000 c.cs.

The metabisulphite should be dissolved in two or three ounces of the tepid water and added to the hyposulphite when it has been dissolved in the remainder.

Coming now to the practical application and uses of the orthochromatic plate it may be desirable to state briefly for the benefit of the novice the case for the colour-sensitive plate. Owing to the great advances in the manufacture of these plates the time has gone when photographers had to balance the merits and demerits of the ortho against the ordinary, and end by carrying the two kinds. The speed of the ortho plate is now equal to any demands likely to be made upon it, which at one time was not the case; the keeping qualities likewise

are so good that no one need hesitate to have them lying by for several months if well stored. It is not necessary to use a filter unless the use of one is desirable; finally and principally, while they will do all that the ordinary plate will do they will likewise do infinitely more when used in conjunction with the filter. This being the case let the beginner in photography commence with the orthochromatic plate and master its working principles. To aid as far as possible anyone making his first attempts with orthochromatic plates it appears to me desirable to state that a large amount of the information given here has been gained in using the Barnet Orthochromatic plate, so that a considerable portion of the detailed particulars would specially apply to that plate. The filter for use with either plate should be about a four times filter, that is, one which increases a normal exposure by four, so that if the plate exposed on a certain subject requires, say, half-a-second's exposure without the filter it will require two seconds when the filter is used. It cannot be too strongly urged upon the inexperienced to let the plate manufacturer supply the filter, at least until the worker has gained considerable experience in orthochromatic photography, and now that excellent filters are supplied at a nominal price there is no necessity for the home manufacture of them, nor could the amateur manufacturer hope to turn out successful filters without special appliances and great experience.

The position of the filter when in use is either inside the camera, behind the lens, or on the front combination of the lens. My own preference is for the inside position, but much depends on the

shape and mounting of the filter. If several lenses are used on the one camera a square filter fitted in a frame affixed to the inside of the camera front permits of its use with all of them. The frame should be hinged in order that it may be turned aside when the filter is not required for use. The outside position of the filter has one advantage; if from any reason at the instant of exposure the operator decides the plate would be better exposed without the filter then it can be easily removed without disturbing the plate. This necessity not infrequently happens in landscape photography where conditions may alter appreciably between the time of arranging the camera, inserting the dark-slide, and making ready for exposure.

In landscape photography the filter and orthochromatic plate have worked a complete revolution. The startling difference in tone values was at first objected to by the older photographers who had accepted the inferior translation of the ordinary plate and could not see in the superior gradation and truer rendering of the orthochromatic plate a far finer transcript of nature than could ever be obtained by a plate having its greatest sensitiveness in the violets and blues. At page 43 is a reproduction of a landscape taken on a Barnet Ortho plate in conjunction with a four-times filter. In every way the rendering is far superior to anything that could have been obtained on an ordinary plate, although much of the fine quality of the tone values cannot be seen to such advantage in a reproduction as in an original print.

It is the power of rendering sunlight effects that has made the orthochromatic plate so valuable in

landscape photography. Take as an example a moorland view dappled with patches of sunlight and expose two plates upon it, an ordinary and an ortho with a filter; compare the prints from the two negatives and it will be found that the sunlight has completely vanished from the one whilst the other always recalls the moorland as it appeared with the sunlight touching it here and there.

Another office of the filter, and one especially valuable to the landscape photographer who values topographical qualities, is the great improvement it effects in negatives taken on dull days, when the landscape is grey and even in tone. By the use of the filter the greens are brightened and a considerable portion of the haze obscuring the distance got rid of, and where a flat poor negative would result with the ordinary plate a very satisfactory one may be secured with the colour sensitive plate and filter. It is on such occasions as these that a deeper coloured filter may with advantage be used, but care must be taken that a full exposure is given, otherwise over correction of the greens may result, and the objector to orthochromatic photography point the finger of scorn at the tone values. In woodland photography the orthochromatic plate scores heavily on account of its superior sensitiveness to the greens. It is not always necessary to use a filter to secure the additional superiority, as when the subject is dense forest woodland the canopy of branches diminishes somewhat the activity of the rays from the sky and the greens are less influenced by the blue rays. In autumn the translation of the tints if a filter is used is far more satisfactory than might be thought possible by a monochromatic reproduction.

I have made careful comparative exposures on woodland glades in the New Forest when brilliant with autumn colouring, using orthochromatic plates both with and without a filter, and I found that to get a negative giving some idea of the luminosity of the glades and their colouring it was necessary to use a pretty deep filter; without a filter even an orthochromatic plate failed altogether. When attempting such difficult subjects the plates should always be well backed, as it is necessary to give a full exposure, and it may happen that the more active rays commence to solarize the image. Many authorities, indeed, recommend that *all* plates, for whatever use, should be backed, but though there is nothing whatever against such a course it is not an absolute necessity. Where great contrasts exist in the subject, as, for instance, a white-washed cottage illuminated with brilliant sunshine, surrounded by green trees, it would be desirable, but there is not the liability to halation in the modern dry plate that was experienced years ago, and further, the very nature of the orthochromatic plate is somewhat of a safeguard against solarization, on account of the dye incorporated with the emulsion. Quite early in my use of the orthochromatic plate I noticed its greater freedom from this evil. Woodland subjects, certainly, demand a backed plate, just as interiors with windows facing the camera do, and if the operator objects to using backed plates altogether he can compromise by carrying with him a certain number with which to meet emergencies.

So far I have written of an orthochromatic plate used in conjunction with a colour filter, which

is necessary if the best results are to be obtained, but a plate known as a "self-screen" orthochromatic plate may be substituted. This is a plate which practically is ready screened for the user, *i.e.* the filter is included in the emulsion by dyeing it yellow, which lowers its activity to the blue rays and permits of greater action by the yellows and orange. Quite early in the days of orthochromatic photography it was pointed out by Colonel Waterhouse that if the emulsion was dyed with a solution of turmeric a better colour rendering was obtained. This we now know was because the activity of the blue rays was lowered. The Barnet Self-Screen plate is prepared on such lines and where it is desired to dispense with a filter can be substituted for the combination of orthochromatic plate and filter. Of course such plates may be additionally "screened" if the operator for any particular subject or branch of work desires increased orthochromatic effect; that is to say, if the plate used without a filter does not give sufficient colour translation for the work in hand a filter of depth sufficient for the purpose may be employed in the same way as is done with the un-screened ortho plate. It is, of course, very convenient to carry a plate already fitted up with a filter, which is practically what a "self-screen" plate amounts to.

Before leaving the subject of landscape work and orthochromatic plates there is one other application of them I would like to refer to. It is snow scenes. Now that winter sports in Switzerland attract so many, snow scenes are greatly in evidence, and no subject shows up the superior rendering of the ortho plate and filter better than a

brilliantly-lit landscape under snow. The snow-scene photograph of twenty years ago was a mere travesty of the original; muddy-coloured snow, lacking in gradation, against a white sky. Anything more untrue to the original can scarcely be imagined. With an orthochromatic plate and filter the delicate shadows across the surface of the snow are perfectly rendered, and the whole snow-scape stands brilliantly out, not against a *white* sky, but against a tinted background, that in a photographic print is the monochrome representation of the blue sky. Plates for such work should certainly be backed to preserve the crispness of the highest lights.

In these days of "nature-study" increased application of the camera is being made in the field of natural history, and whatever branch occupies the photographic worker he is bound to avail himself of the correct colour translation of the colour-sensitive plate. No pleasanter recreation is open to the amateur photographer than employment with his camera among the wild flowers, both in their natural surroundings and as studies isolated by photographing them indoors. And further, such a course of photography is one of the very best trainings in practical orthochromatic photography it is possible to have. The colours of the flowers photographed have to be translated into their equivalents in monochrome, and each specimen requires due consideration before work is commenced as to the best method of treating it. Take the wild columbine, as an instance; it is an indigo blue flower with dark green leaves; photograph it on an ordinary plate and in the print it is a white

flower; with a colour sensitive plate and medium yellow filter the flower approaches the leaves in tonal value when the negative is printed from, and this is correct to nature. As another instance, take the wild mimulus, a yellow flower with dark brown blotches on the corolla; photograph this on an ordinary plate and you get a dark corolla upon which the blotches scarcely show; with the filter the yellow is well separated from the dark brown patches and a correct tone translation of the original is produced. One hint may be given with regard to flower photography out of doors, that is, when photographing them in their natural surroundings; in the late evening the light loses a considerable portion of its violet and blue and it is possible to get very good colour translation without using a filter. I have had some surprisingly good studies of wild flowers by taking them on orthochromatic plates without a filter just about sun-down. Another point in favour of the operator is that at such times the air is often extremely still, so no movement of the plant from wind interferes with the exposure. Plates of wild flowers, whether indoors or in the field must be fully exposed to secure correct colour translation, and development must not be carried too far. A rather thin negative, full of gradation is the ideal for this class of work; and here again it is desirable to use backed plates, especially if white flowers are in question, as they are apt to solarize against the greens. It is perhaps advisable to use one of the soft working developers for developing flower negatives, or at least such a combination as the metol-hydrokinone developer, as anything like hardness in the negatives is fatal to a

true rendering. It is sometimes extremely difficult to decide upon the best method of treating certain flowers in order to obtain a result that shall not violate the tonal values, and I instance the common blue-bell and wood violet as being very difficult to render satisfactorily in monochrome; of course, to the eye the flower is at once separated from its leaves by the colour, but translated correctly into monochrome the leaves and flowers have much the same value. I usually compromise in such cases by choosing a pale yellow filter, and so keep the flower a little lighter in the print than the leaves.

Closely allied to the use of the camera in natural history is its use in conjunction with the microscope, or photo-micrography, and the term may cover magnifications from a few diameters to one or two thousand, and the objects the trophi of an insect at five diameters, or a blood parasite at two thousand, a plain slide mounted *au naturel* or a slide with the object stained in two colours. In any case the advent of the colour-sensitive plate was an immense boon in this class of photography, if indeed it may not be said to have made modern photo-micrography what it is.

It may be doubted if the colour-sensitive plate and filter have been employed in portraiture, either by the amateur or the professional photographer, to the extent their value would entitle them to be employed. The average professional portrait photographer certainly does not avail himself of the help they offer in dealing with a certain class of sitter, and the amateur probably has not had his attention directed to the matter. It certainly is a matter for exclamation that in these days of superior tone

translation it should be necessary for an auburn-haired lady to regret that when she is photographed her hair always looks black in the print, or that one with blue eyes should feel apologetic because her eyes "never photograph well." Both matters are quite easily corrected by the use of a suitable filter, and that also without the exposure being other than the briefest if a rapid orthochromatic plate is used. In this connection special attention may be drawn to the Barnet Ortho Super-Speed (H. & D. 500) and the Ortho Self-Screen (H. & D. 300) in their special form when coated with a matte emulsion. In addition to the usual orthochromatic advantages of these plates, with or without a filter, the fine matte surface of the emulsion eliminates halation, makes spotting and retouching easy, and markedly enhances the beauty of the resulting prints.

In all telephotography the filter may be considered to be absolutely indispensable. The amount of haze nearly always present in an English landscape would seriously interfere with the detail of distant views unless a large part of it was removed by a filter. For this class of work Captain Wheeler recommends that two filters should be carried, one increasing exposure about four times and another increasing it about ten times, and an experienced landscape photographer knows the value at times of a deep filter in obliterating dense haze. The filters for tele-photographic work require to be of considerable optical excellence, otherwise definition is interfered with. Exposure in tele-photography is generally acknowledged to be the principal stumbling block in its successful prosecution, especially with the beginner, so it may be some

comfort to the novice to know that when a filter is used the risk of failure from over-exposure is very much lessened. In fact this applies in all cases in which a filter is used ; an amount of over-exposure that would be ruinous to a plate exposed without a filter would scarcely matter if given to a plate with the filter. This is largely due to the fact that the deep shadows of the foreground are protected by the filter and so remain to give vigour to the negative. On account of the tendency in the filter to cause under-exposure in the immediate foreground various devices have been employed whereby the "screening" effect may be confined to the more distant parts of the landscape. The most satisfactory is a filter less deeply coloured in one half, which permits of the dark foreground receiving more exposure. At the best these devices are more or less compromises, and if a correct exposure is given the latitude in the plate will prevent any serious deterioration of the distance while allowing of full detail in the darker portions.

In the narrow limits of a paper like the present it is impossible to do more than touch suggestively on the many applications of orthochromatic photography. What the ordinary dry-plate was to the wet collodion plate in its superior speed and convenience, such is the modern ortho plate when compared with the ordinary un-orthochromatic. It has enlarged the realm and possibilities of photography as no other single discovery has done, and no considerable advance in photography is dissociated from the colour-sensitive plate and filter.

HIGH-SPEED PHOTOGRAPHY

BY

ADOLPHE ABRAHAMS, B.A., M.D., B.C., F.R.P.S.

(The photography of moving objects has a fascination all its own. Dr. Abrahams has long been recognised as an authority on this class of work, and offers much sound advice here. Two illustrations of foot racing are given at page 59).

IT is a very consolatory reflection to a writer who has been asked to compress the whole of a large subject into a very limited space, when he realizes, as in this instance, that he is not dealing with details which demand particular natural gifts, such as the artistic temperament or acquired skilfulness, other than those which may be obtained by anybody with ordinary opportunities for practice.

My subject resolves itself practically into two heads: specific advice directed to the choice of the special apparatus which is necessary in this work; and instructions which relate to the actual procedure of using such apparatus upon the various types of moving objects. I should like at once to premise with regard to the latter that in a short article little more than the barest introduction is possible. It might, however, be added that comparatively little more could be achieved by a writer with unlimited space. The high-speed photographer, it is interesting to reflect, can be, and nearly always is, an absolute empiric regarding the purely technical

side of photography. His ignorance of chemistry and physics may be complete; ***his success depends entirely upon his expert acquaintance with the peculiarities of the subject he desires to portray.*** It might, it is true, be argued that the same criterion applies in the case of every other branch of photography. I am not prepared to debate on this point, nor is there any need to do so; but so much misapprehension appears to arise in the case of the branch now under consideration to the effect that a successful exponent must necessarily possess a mysterious knowledge compounded of the occult and of the shifty, that I think it as well to emphasize this point at the outset, and to warn readers that to a great extent their success can only result from the experience they themselves acquire, and that all I can do is to erect a few finger-posts to point the way, which, to continue the parallel, have been erected by a traveller who has himself taken the wrong path on innumerable occasions.

I have said that it is part of my duty to refer to the *special* apparatus needed in this work. Now occasionally it is demonstrated that a shutter with a speed of 1/100th sec. — such a shutter as is provided with most *ordinary* hand cameras — is suitable for a not inconsiderable number of comparatively rapidly moving objects.

But it must be realized that such a statement is really begging the question. It assumes that the photographer will be willing to rest content with absurdly small images of his moving object, that he will be skilful enough to select, as they put it, the moment when the movement is at its slower or slowest phase; and that, finally, he will be

reconciled to relinquishing the photography of all objects which he knows to be extremely rapid in their movements.

In my experience the attempt to proceed far in the pursuit of moving-object photography with a shutter of this description is accompanied by many disappointments, and the enthusiast too quickly chafes at the inevitable restrictions which his apparatus imposes. Reduced to its fundamentals, the special apparatus for high-speed photography comprises only two items : a suitable shutter and a suitable lens. The camera is, after all, only an appendage to these, and other accessories are merely details.

It will be necessary to have a shutter capable of giving speeds from 1/250th sec. to 1/1000th sec. Later I explain that these figures are quite arbitrary and often the merest approximation.

A few subjects come into the range of high-speed photography although the exposures needed are no faster than 1/100th sec., but, speaking generally, very little high-speed work can be said to begin at a slower speed than 1/400th sec.

Until comparatively recently only one type of shutter was capable of giving such rapid exposures, *viz.*, the focal-plane type. In fact, up to a few years ago, we employed the terms "focal-plane photography" and "high-speed photography" as synonymous. At that time, however, Messrs. Ross imported from America a new between-lens shutter called the "Multispeed," the introduction of which may be said to mark an era in the history of the photography of moving objects. At the present day the position of a would-be high-speed photo-

HIGH SPEED SUBJECTS

(Dr. Adolphe Abrahams.)

grapher is, briefly, as follows. He can buy a camera fitted with a focal-plane shutter, such as a reflex or a folding type like the Ross "Panros"; or he can have such a shutter fitted to a suitable camera he may already possess, an adjustment which involves a certain amount of expense and trouble and is, moreover, not always possible. On the other hand, he can have any camera he happens to possess converted at once into a high-speed apparatus by the simple proccss of adapting a "Multispeed" shutter to his lens, assuming, of course, that the latter is not of so great a size that no "Multispeed" shutter is large enough for the purpose.

Finally, if he desires to use the "Multi-speed" on a camera of the reflex principle, he can employ a twin-lens model, as I have done, in the case of the well-known instrument made by Ross, with which combination I have secured some of the finest high-speed photographs which I venture to think have ever been produced.

A few words on the comparison between the focal-plane and the "Multispeed" shutters will not be out of place. The focal-plane shutter, from its simplicity of use and its more general utility at all speeds, will always be first favourite. The claims of the "Multispeed" are these. It easily surpasses any focal-plane shutter when it comes to a question of the really rapid exposures, and, as I have already stated, its adjustment to any existing camera is a much less formidable undertaking than in the case of the focal-plane.

Were the "Multispeed" shutter a little more convenient to set and adjust, I should never fail to

employ it for any exposure faster than 1/400th sec., because its efficiency is very much higher than that of the focal-plane; that is to say, if identical exposures are given with the two shutters, a better exposed result is yielded by the "Multispeed."

In this connection it is necessary to destroy a very long-standing, and therefore deep-rooted, misconception. The focal-plane shutter is generally credited with the possession of an efficiency of 100%. If it worked absolutely at the focal-plane its efficiency would be 100%; but the inevitable removal of the shutter some distance, however small, in front of the plate, decreases the amount of light which reaches the plate, and the wider the aperture of the lens and the narrower the slit used—the usual accompaniments of high-speed photography—the greater the loss of light; until with a lens of f/6·3 and a speed of 1/1000th sec., the efficiency often sinks to as low as 43%. Of course, the efficiency is lower still in the case of those badly-built models in which the shutter is placed in the body of the camera a considerable distance from the plate. At low speeds, and with small aperture lens, the focal-plane shutter has a high efficiency, practically 100%, but that does not concern us here. On the other hand, the "Multispeed," whilst relatively unsatisfactory at low speeds, has at high speeds an efficiency of 55% to 65%, so that its advantage over the focal-plane is really considerable. Forty to fifty per cent. more light may be utilized, naturally an enormous gain in work in which under-exposure is almost invariably the rule. An additional advantage of the "Multispeed" is that, in the case of very rapidly-moving objects, their photography is

achieved without the lateral distortion which occurs when a focal-plane shutter is employed, on account of the plate being exposed in portions, and not as a whole. The most familiar example is the long drawn out image that is produced when a very fast motor-car is photographed at right angles. I recapitulate briefly the points which should influence a purchaser of apparatus for high-speed photography. If expense is no great object the ideal outfit would be a good-class reflex with focal-plane shutter, and a camera with a lens to which a "Multispeed" shutter is fitted. If the latter camera is of the twin-lens type, he will then be in a position to photograph to the best advantage every high-speed subject that can be encountered.

If he can buy one camera only, he will probably do best with a focal-plane instrument. It is not my intention to deal further with cameras, but I may say that the remarkable certainty of a reflex and its universal application commend this type of camera to me as unquestionably the best for the amateur.

If he already possesses a camera and wishes to use it for high-speed work, granted, of course, that he has a suitable lens, the minimum expense will clearly be incurred by the adaptation of a shutter, either "Multispeed" or focal-plane. But the reader must understand that his work must inevitably be restricted if he does not possess a camera specifically adapted for high-speed work. Many cameras to which a shutter can be fitted must be regarded merely as makeshifts if they do not possess the conveniences which are so urgent in the rapid

manipulation called for in the photography of moving objects.

A final warning may be directed to the adaptation of a focal-plane shutter to an ordinary camera. The purchaser should select a well-known make and insist that it must be fitted very close to the plate. If the construction of his camera prevents such a position he had better abandon this type of shutter altogether.

THE LENS.—Although it is obvious that a lens of wide aperture is a *sine qua non*, this does not mean that the beginner should rush away and buy one working at f/4·5. Unless he is purchasing a whole battery of lenses to be equipped for every emergency, he will find the applications of a lens of this aperture too few to justify the expense. I advise a good anastigmat working at f/6·3 as the ideal aperture for general use. I have photographed the highest speed subjects for nearly fifteen years all over the world under the best and the worst conditions, and the only occasions when I have felt myself compelled to employ a very wide aperture lens could be numbered on my fingers.

I am well aware that many will disregard this advice. Time after time I have expressed this opinion, time after time I have been thanked, but—"I think I will get a faster lens, thank you," and time after time I have received letters which are all so much to the same effect that a printed form could suffice, "I *do* wish I had taken your advice. I bought a —— lens, working at f/4·5, but I can't use it unless I stop down considerably, as I can't get things sharp." Of course he cannot get things sharp; the depth of focus of a lens of this aperture,

unless it is of extremely short focal length, is exceedingly small. And if there is one maxim I would utter and repeat and write in flaming letters, it is that the first requisite of a high-speed photograph is sharpness of focus. Now at f/6·3 you have an aperture which is large enough for almost any purpose, and yet gives a satisfactory depth of focus for high-speed work. The manufacturers have been careful to consider this requirement, and practically every firm of any standing produces an anastigmat of this aperture with a focal length of about 5 inches for quarter-plate, and perhaps 7½ inches for half-plate size. There is another reason why such a lens is particularly acceptable; it is usually composed of two components, each of which is corrected and constitutes a lens of long focus, generally about double that of the combined lens. I must admit that this latter advantage does not appeal to me with such force as a few years ago, as the recent introduction of the "fixed focus" telephoto lenses of the "Telecentric" type have revolutionized long-focus "instantaneous" work. If there is one feature which I would choose to the exclusion of all others as epoch-making in the branch of photography of which I am treating, I would put my finger upon the production of these lenses. The lens I frequently use works at f/5·4, has a focal length of 17 inches, and gives the exquisite definition of a highly-corrected anastigmat. The single components to which I alluded above are good in their way, but naturally their aperture—generally half that of the combined lens—limits their application. In the old days I did very good work up to 1/400th sec. with these single components, and if

the reader desires to purchase one lens alone he will be wise to decide on such an anastigmat, which will always be a sound investment.

A few words may be spent upon the use of long-focus lenses in high-speed work. A long-focus lens gives a larger image than a short-focus lens when both are used at the same distance, and the former will be useful, therefore, when it is impossible to get near enough to the subject, *e.g.*, when working from a restricted position; or when it is undesirable to do so, as in the case of photographing a nervous horse; or when it is dangerous to do so, as in taking a man throwing "the hammer." (A cricket match embodies all these objections.)

In the second place, a long-focus lens gives a much more correct perspective, by which I mean that objects at different distances from the camera are rendered in more correct proportion. This may not seem of very great moment to the inartistic high-speed man, but there are, in reality, a number of subjects which demand such a critical consideration. As an outstanding example I would remind the reader that a racing eight is 60 feet long, and the disproportion between "cox" and "bow" (the men at the extreme ends) tends to appear ridiculous if a short-focus lens is employed. Of course the long-focus lens has relatively little depth of focus, but then one does not use a lens of this description except for special purposes, or until one has acquired a fairly considerable experience. As a matter of fact, the perspective rendered by these modern lenses of the "Telecentric" type fascinates me so much that I am in danger of using them to the entire exclusion of practically all other lenses,

except, of course, when I desire to use the "Multi-speed" shutter, to which they cannot be fitted. The "Telecentric" lens can hardly be called a telephoto lens, but rather a very long-focus wide-aperture lens.

I have postponed the consideration of real telephotography in high-speed work until the end of the article. I have emphasized the enormous importance of sharpness of focus, and I may here refer to an adjustment which is often of considerable service in this connection. It is clear that sharpness is more easily achieved when the depth of focus is increased, and inasmuch as focus depends upon the distance between plate and lens, the swing-back or the swing-front can be manipulated to bring all parts of the plate simultaneously into focus. In high-speed work, more especially if a reflex is used, the swing-front can be easily adapted. I have used it repeatedly with a lens at f/6·3, and so obtained a result which, as regards depth of focus, was equivalent to f/64. Familiar examples of its use are the photography of a long string of runners at a corner or a subject with objects at varying distances taken from a height when one is not quite sure at which point the moving object will be when exposure must be made. It calls for a certain niceness of adjustment, and its improper use leads to distortion. But so long as one can be sure of the *angle* at which the camera is to be pointed its advantage is remarkable; and although it has received very little patronage from other high-speed workers, it is undoubtedly a valuable weapon in the armamentarium of the photographer who wishes to be prepared for all emergencies.

THE PLATE.—The most important characteristic of a suitable plate for high-speed work is its density-giving property, what is generally termed "Gamma infinity." The best plate, therefore, is one which combines the highest density-giving power with the maximum speed consistent with that property. It is useless to select a plate with a phenomenal H. & D. value without enquiry as to its other characteristics. The leading firms are alive to this, and they supply rapid plates which are still capable of being forced in development. The Barnet "Red Seal" and "Super-Speed" are fine examples of such a plate. But it must be borne in mind that in the use of plates and developers enormous variation exists in the personal equation of the worker. That is the reason why I fail with some materials with which other men produce first-class results. And, similarly, although other experts favour the very highest speed plates to which I have alluded, I am much more disposed to use a plate of lower H. & D. value, *e.g.*, the Barnet "Special Rapid" (H. & D. 225), because a plate of this description has a particularly high Gamma infinity. Thus the paradox uttered by Sir William Abney a good many years ago that "the slowest plate is the fastest" has met with no little endorsement by modern high-speed workers. The moral clearly is to avoid following any successful worker slavishly, especially if you have had experience with any one kind and speed of plate, and, I may add here, developer. You will learn the particular peculiarities of this plate, because although different emulsions agree in the main, they necessarily differ in details, and it is presumably the recognition of these differences, trivial though

they may be, which makes for success by one worker whilst another signally fails.

Developers.—It is something for the beginner to realize that not even the most experienced can do any more than make the most of what decomposition the light has effected. This is a platitude, yet I am encouraged to issue it in self-defence, in repudiation of knowing any mysterious formulæ which can make a plate yield up what was never there. There are naturally many different methods of developing under-exposed plates, and I do not doubt that different workers obtain equally good results by widely differing methods of manipulation, which, again, endorses the wisdom of sticking to one kind of plate and learning the best means of making the most of it. A long experience, which includes the investigation of every developing agent, from the flashy pyro-metol to the longest method of stand development by glycin, confirms me in my opinion that on the whole nothing can surpass pyro-soda, using as little pyro as possible (three grains to the ounce), omitting bromide, diluting the solution to two or three times below the strength usually recommended, working with the room and all utensils at a temperature not lower than 65° Fahr., and prolonging development as long as it is safe to do so. Of course each plate requires individual careful attention. For a well-exposed plate—and under the best conditions even high-speed results can be well-exposed—pyro-soda is unsurpassable, whilst I am convinced that it will produce a better result with under-exposure than any other reducing agent can do. Metol-hydroquinone is another good developer which gives cleaner and prettier negatives,

but there is something especially good about the dirty yellow-stained effects which pyro-soda produces. Particular care must be taken in cold weather to warm a metol-hydroquinone developer, as hydroquinone is almost inert at low temperatures. Practically none of the other well-known developers is worth further consideration here. They work admirably when exposure has been fairly full; they fail, however, in difficult cases, and it is the all-round excellence of pyro-soda which particularly commends itself to me.

Exposures.—More rubbish is talked about this topic and more controversy arises when exposures are discussed than about the rest of photography put together. To ask what exposure to give without enunciating all the circumstances is as absurd as asking the dose of a drug without stating whether for an adult or an infant, and under what conditions it is to be used.

Is it not evident that some absolute criterion must first be laid down, as, for example, at what distance from the moving object the camera is to be situated or, expressed in other words, with what sized image we shall rest content? Is it not clear that a very slow exposure will serve to arrest the motion of the most rapid object if it is taken a very long way off, and that even a comparatively slowly moving object photographed at very close quarters will demand a rapid shutter exposure? In other words it is relative, not absolute, displacement that determines the rapidity of exposure.

There is another factor to be taken into consideration. Calculation of the exposure needed to arrest motion, if based solely upon the velocity of the

moving object in a straight line is certain to produce failure in many cases. A runner at full speed, for example, is travelling perhaps twenty miles an hour, but parts of his limbs are moving many times faster than that, and even the contortions of his facial muscles demand a very rapid exposure. It is, in fact, the additional movements in many high-speed subjects which necessitate an exposure at first sight disproportionately rapid when the forward velocity alone is considered.

Exposures can be longer when the object is travelling away from the camera, but such a position is seldom utilized. It is generally stated that relative motion is three times as great when the moving object is at right angles to the camera as when it is travelling straight towards it. Without admitting such an absolute comparison, there can be no doubt that the shutter in the former case must be driven very much faster, and that if a focal-plane shutter is used upon these objects at right angles to the camera, bad lateral distortion will inevitably be produced unless the tension of the spring is at its highest.

It will be well for the beginner to realize two important facts. The first is that the speeds marked on a shutter are, in most cases, mere figures of speech, often differing enormously from the actual speeds. The second is that this doesn't matter in the slightest, provided that the speeds are relatively correct, that the exposure marked 1/1000th sec. is about half that marked 1/500th sec., and so on.

And every worker must standardize his own shutter. He will learn more about exposures by

exposing half-a-dozen plates upon familiar moving objects than by perusing miles of literature with charts, tables, formulæ and other schemes. It is useless for me to say to him, give 1/1000th sec. for a certain subject under certain conditions. How do I know what the speed called 1/1000th sec. on my shutter corresponds to on his? And if he buys a new shutter, having already standardized one, he must begin the same process over again, giving its fastest speed upon the same type of moving object and estimating at once by results what the speed of the second shutter really is.

Some kind people will temper the wind to the shorn lamb by explaining that longer exposures can be given if the moments of comparative immobility, or in fact temporary complete suspension of motion, are selected for making the exposure, *e.g.*, a runner's foot on the ground, a diver at the top of his flight, a golfer at the top of his swing, and so on. This is perfectly true, but the photographer will have to rely upon Fortune's kindness to place this convenient position just where he wants it, that is to say, at the point of sharp focus. And, in addition, it is pertinent to suggest that by the time the photographer has developed sufficient skill to hit off these moments accurately he will be far beyond the need of tutelary articles.

HIGH-SPEED SUBJECTS.—Quite apart from the more exact and obvious classification of rapidly moving objects, a convenient distinction may be drawn between two main groups: those which are perfectly easy and those which are more or less difficult. The latter can be subdivided into any number of smaller groups.

Excluding a very few rare examples, difficulty depends solely upon the question of sharp focussing. A subject is, in fact, difficult to photograph exactly in proportion to the difficulty of ascertaining in advance its exact position at the moment of exposure ; or, expressed in other words, in proportion to the existence of opportunity to focus upon the position it will occupy at the moment when the exposure must be made. (I would briefly remind the reader that here I am dealing entirely with the technical side of the work, which has nothing to do with the experience of details of the subject one is depicting, study in which can never be at an end.)

For even to the point of tediousness I must re-iterate that sharp focussing is the first and most important feature of a successful high-speed photograph. "Evidence of motion" is desirable, but that means the securing of a phase of arrested motion when movement is obvious, and it must be carefully distinguished from movement during the exposure, that is to say blurring, which is, of course, inadmissible. The latter is often indistinguishable from the blurring due to inaccurate focussing. In fact, inaccurate focussing accounts for blurred pictures of moving objects far more often than is generally supposed.

The easiest subjects upon which a beginner can start are obviously those which can, if necessary, be focussed for hours beforehand, and exposure upon which can be repeated with the correction of any mistakes made. Such examples are almost self-evident : erection of an obstacle for somebody to jump, skipping through a hoop. The next stage in the high-speed photographer's evolution will be

to photograph somewhat similar objects which can be focussed beforehand, but in which a little more judgment is called for in making the exposure, and in which repetition *ad lib.* is not possible. Examples are finishes of races, hurdle races, the high jump, railway trains at full speed. And here I would point out that the last-named is one of the best possible exercises for the beginner, for it is the easiest thing in the world to focus on the fixed point beforehand, and he can repeat the experiment day after day; whilst the circumstance of dealing with a very rapid object at close quarters is splendid training for his nervous system.

A Practical Hint.—Always watch the moving object directly, never upon the ground glass of a reflex, nor in a finder, except, of course, one of the cross-wires direct-vision type. And learn to train yourself to expose when the moving object has reached (or, to speak with psychological exactness, appears to have reached) the desired point. It would take too long and would be outside the scope of this essentially practical article to enter into the philosophic principles which underlie this piece of advice; I would ask the reader, therefore, to accept as a fact that this is the only method by which he can train himself to become a 100% man; and it is only the man who never fails to make a good shot who can be called a successful high-speed photographer.

To continue with our scale of difficulty. A diver whose path through the air is evident, but whose exact position at the moment of exposure has to be estimated, would come next. The most difficult subjects of all will be isolated events in football,

when the future course of any movement can never be inevitable, and when one has to come to an instantaneous decision when to expose, so that the only means of securing a sharp result is to focus beforehand on a fixed distance which is kept in one's mind.

I have frequently seen it advised to practise judging distances so that the lens may be instantly set for any distance needed. I have no desire to multiply difficulties, but I feel it is only fair to express the opinion that to judge distances with sufficient accuracy calls for experience which can only be described as enormous. For approximate results are of no use, there is little margin for error when comparatively wide aperture lenses (with little depth of focus) are used. Preliminary focussing of some kind may, for the ordinary amateur, be regarded as essential, a procedure which is clearly of the greatest ease when a reflex is used.

With these general considerations I may expend the rest of the space at my disposal by giving a very few specific details which apply to particular high-speed events. It will be evident to the reader on momentary reflection that there will be very few subjects for the high-speed shutter which cannot be comprised under "sport."

Athletic Sports are such familiar occurrences and the various events are such excellent subjects, that a great deal of the photographer's early experience should be learnt on the track. The exposure required in the short-distance running events will be very rapid. Finishes are almost invariably taken end-on, in fact angles are best avoided; intermediate stages of longer distance races compose

best at a corner. I can only advise that each photographer must study the question of angles and size of figures and work the exposure out for himself.

The exposure needed for the high and pole jumps and the hurdle race are fairly rapid, because the limbs move so rapidly. In the long jump a slower exposure suffices. In taking the high jump always spend a little time studying the athlete's action, to learn the peculiarities to illustrate. For this reason, in this and in the pole jump, it may often be advisable to photograph from behind.

In photographing jumping of any kind, be scrupulously exact in taking from as near eye-level as you can. Kneeling down and pointing the camera upwards, as many pressmen do, exaggerates the appearance of the height of the jump, but it leads to distortion and is always best avoided.

FOOTBALL.—The easiest episodes are very easy, the difficult ones are among the most difficult that a photographer ever encounters. In Rugby football the "line-out" should be first attempted, because the point of re-entry of play can be focussed; in Association the simplest procedure is to stand near a goal and wait prepared. The more expert photographer will aspire to illustrate isolated incidents and the best plan is to set the lens at a focus so that objects about ten yards off will be sharp; keep this distance fixed in your mind and expose to right or left as suitable events occur. HOCKEY and LACROSSE offer similar possibilities.

In the photography of all games, practical acquaintance with their details is a conspicuous feature in determining success. The hackneyed results of some newspaper men are due to their want

of recognition of the particular incidents which only knowledge of the game can suggest.

CRICKET is a difficult game to photograph. Earliest attempts should consist solely in photographing net practice—from the back of the net. Later, useful practice is afforded by "arranging" studies; a ball is bowled up so that the batsman may cut it when desired, and so on. The photography of such details as a man being actually bowled in a *bona-fide* match calls for extreme control over the camera, and a fair share of pluck. I may as well say that the faked pictures one occasionally sees will always be found out, as some detail is forgotten or wrongly arranged. The press photography of cricket is nowadays mainly telephoto work, and this is rarely attempted by the amateur.

HORSES are subjects for the high-speed shutter which have given rise to a great deal of controversy, as they are invariably advanced as horrible examples of the camera's perpetrations when contrasted with the pleasing effects which the imaginative artist draws. This, however, has nothing to do with a practical article, and as it is clearly impossible to deal with the many subjects into which horses enter except in the very slightest detail, all I need do is to remind the reader that trotting will give some very pretty effects, galloping some interesting ones, and jumping will afford an opportunity for a great deal of ingenuity. The various items of military sports offer some of the most difficult subjects one encounters, which are also among the most satisfactory when successful.

POLO is a game which is, on the whole, unsatisfactory for the camera, since only four a side take

part, so that it is generally impossible to include sufficient figures to divide the interest. Isolated episodes of a really animated nature are only obtained through great good luck.

The press photographs one usually sees of HUNTING are hardly high-speed results, but mainly comparatively slow exposures on well-known personages. A real hunting picture is about the rarest photograph one meets.

In ROWING the use of the long-focus lens is seen to its best advantage. I never dream of photographing an eight without such a lens, and if the eight is too near for its use I deliberately allow it to get further away until it has reached the right proportion. An exceedingly pretty picture is always secured by photographing an eight from a bridge. Comparatively slow exposures suffice, 1/150th sec., perhaps. The best position to illustrate is when the men are reaching out right forward with the blades square, ready to be dipped.

In LAWN-TENNIS the service will prove most profitable, as other features are very difficult to secure, whereas the player can be focussed beforehand in service. A great many different features are presented by different players, and it is well to watch a few services before photographing, to see what is the typical feature to secure—*e g.*, the height the ball is thrown up, the grace of a "follow-through," etc.

Similarly in GOLF the drive shows the characteristic of the player. The highest-speed shutters are needed in all positions except that of the extreme finish of the follow through, when movement dies down. Playing out of a bunker, showing the flying

ball and sand and other *debris*, is always a very attractive picture.

In photographing DIVERS one is often obliged to take up any position, however unsuitable. Unless the light is exceptionally brilliant care should be taken to avoid the inclusion of objects in the near foreground, as the best chance an under-exposed figure has will be when outlined against a very distant background or the sky. Of course, such an object as the diving board will, if included, add to the reality, but it is of objects which tend to clash with the diver of which I am speaking. Variations, such as jumping, back-diving and other trick events, will always be taken if opportunity arises.

SWIMMING is an unsatisfactory subject to photograph, since only a perfectly unruffled piece of water will permit the limbs and body to be visible, a feature which is essential to success.

WATER-POLO practically amounts to football in the water and demands no special remarks, except that exposures need not be quite so rapid as in the case of football.

YACHT-RACING only just touches the fringe of really high-speed photography. It is by far the most pictorial of all moving objects. Success lies in recognising that the critical moment for exposure is determined by the beauty of the yacht's lines in that position, and calls for expert knowledge, although this applies equally to every subject in high-speed photography.

WINTER SPORTS — SKI-ING, TOBOGGANING, SKATING—are in themselves not difficult high-speed subjects. Exposure is generally pretty full, on account of the actinic conditions, but more care in

development is needed to avoid excessive contrasts. I do not find orthocromatic plates of any particular service in this work, although the conditions of Alpine sky and snow would seem to call for them.

HIGH-SPEED TELEPHOTOGRAPHY.—It is improbable that two readers in ten thousand will desire to take this up. It is, of course, long-focus work, to which reference has already been made, carried to an extreme. With the exception of certain apparatus made definitely to order, as used by the advanced professional press-workers, the only telephoto high-speed camera is the "Magnar," which I have used with much enjoyment. This is a quarter-plate focal-plane camera to which is attached a lens-system working at f/10, and possessing a focal length of 32 inches. Such a camera is naturally expensive, and it is only for the expert, as it is very heavy and the focussing has to be performed with great care. Its most practical use is at cricket matches; when standing at the top of a pavilion one can secure satisfactory pictures of all the incidents, and I know few more fascinating experiences than waiting ready to make an exposure as soon as a man is bowled, whilst taking observations through the little prismatic monocle which is attached to the camera. This camera has also been employed for the photography of big game and affords the modern equivalent of big-game shooting. In addition to cricket, I have used the "Magnar" to illustrate most episodes of high-speed work. The results have sometimes been very remarkable, the definition say of the finish of a race taken fifty yards away being as clear and sharp as if produced by an ordinary short-focus lens used

eight yards away, although the perspective is, of course, different.

*   *   *   *

It seems almost absurd to insist upon specialism in the various groups to which reference has now been made. But practically every high-speed worker of any prominence, no matter how interested he may be in his art generally, finds it of advantage to direct his energies particularly to some one subject or group. As I have said, the technical side of high-speed photography is really very trivial, but the practical details of the subject one is taking afford a never-ceasing topic for specialization.

REFLEX CAMERA WORK

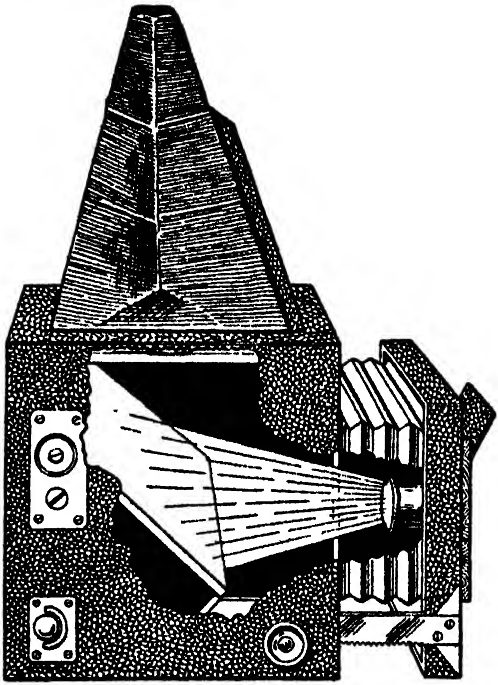
GEO. E. BROWN, F.I.C.

(In this article useful information and hints in connection with the now popular reflex camera are given by the Editor of the "British Journal," himself an expert user of the instrument.)

AS an enthusiastic user of a reflex camera my aim in this article is to deal with reflex work, not only for those who have a camera of this kind, but for those who aspire to possess such an instrument. I have no doubt that the figures of camera sales would show that the reflex users are altogether out-classed as regards numbers by those of any other type. But one may be certain that every hand-camera worker aspires to be the owner of a reflex, and therefore what I say should include advice as to the movements which are most essential to satisfactory work.

Briefly the prime advantage of a reflex over any other pattern of hand camera is that it sweeps away the uncertainty of focussing and selecting the picture. You see the full-size picture ; and you can focus exactly any part of it, however large the aperture of the lens, however long the focus, or however near you are to the subject. With an ordinary camera, as every hand-camera worker knows, it is easy enough to get sharp pictures if the lens is stopped down, if it is of very short focus, or if the subject is a great way off. But in proportion as the conditions depart from these it is increasingly difficult, when focussing by scale, to be certain of getting sharp negatives.

And it is the same with placing the subject on the plate. The ordinary finder at the best of times is not infallible, and with almost all hand cameras it is decidedly misleading when you raise the lens. Not so, the reflex. When the rising front is used, the effect is automatically seen on the focussing



screen. While some descriptions of hand camera provide one or other of the facilities I have mentioned, none but a reflex provides all, and hence I believe it will continue to grow in popularity, despite its drawbacks.

For of late it has sometimes been said that the reflex camera has had its day. We are told

that the ultra-portability of pocket and vest-pocket cameras will triumph over the reflex, despite the many advantges of the latter. I give that prediction little credence because, with some experience of both these classes of camera, I am convinced that the reflex cannot be approached by any other type of hand camera. True, it has its limitations, but its immense facilities far outweigh them. The chief objections to the reflex are its weight, bulk and cost. The first two need not be excessive; the third, as I will show, is greatly discounted by economy in use. But at the outset it is most necessary to bear in mind that there are reflexes *and* reflexes. Of all cameras, the reflex requires to be well made; the choice of too cheap a pattern may be disappointing. Such reflexes may now be bought in a score or so of models at prices from little over £10 to about twice that sum in the quarter-plate size. But I advise the would-be purchaser to choose one of the cameras more expensive than these. Actually he need not pay much more, for the leading makes of reflex are readily obtainable second-hand in working condition equal to new. The reader will be able to judge from what follows which are the most valuable features in a reflex, and for what reasons.

The principle of the reflex camera—now half a century old, by the way—is simple enough. A mirror is interposed at an angle roughly of 45° between the lens and the back of the camera. The full-sized image is seen and focussed on a ground-glass at the top of the camera. When the exposure is made, the mirror rises, covering the focussing screen and at the same time actuating the shutter.

There being now an uninterrupted space between the lens and the back of the camera, the picture is formed directly there.

I have already mentioned in brief the salient advantages of a reflex camera, but on these I must make one or two further comments before passing to the choice and use of a reflex. As compared with a hand camera, where one focusses for sharpness by

Fig. 1.

a scale and arranges the subject on the plate by means of a finder, we are at an enormous advantage with a reflex. In it the ground-glass is placed at the same optical distance (*via* the mirror) as the plate from the lens. We can focus with absolute certainty, in the case of a properly-adjusted camera, of securing the same sharpness in the negative that we see with the eye on the ground-glass. When focussing by scale there is, first of all, the difficulty of correctly judging the distance of the main portion

of the subject and, secondly, of estimating the "depth of focus" which the lens will give—that is the extent of subject (in front of and behind the chief object) which will be sharply rendered. With the reflex we substitute actual seeing for guessing. And we can use the lens to the best advantage in getting, say, general sharpness of a subject or, on the other hand, in picking out one part to be sharp and leaving the rest in softer focus.

Fig. 2.

Then again as regards the finder. Its indication is true only with the lens in the one position in which the finder was adjusted to it; and it is true only for that particular focus of lens. With the reflex you may raise the lens as far as you will; you still see on your focussing screen the exact picture you are taking. Also, when you use, say, half of the lens or an objective of any other focus, the

reflex is still automatically a true register of the picture obtained on the plate.

In short, the reflex has the exactness of working of the stand camera with the speed in use which follows from dispensing with the tripod. It cannot be used for wide-angle pictures, but with this exception the tourist will meet with very few subjects indeed which call for a greater range of movement

Fig. 3.

in the way of extension or rise of front than is possessed by a reflex of double-extension pattern.

I have referred to bulk and weight, and one must concede that in anything like a fair size of camera they are both formidable. A quarter-plate reflex is a square box of size from 6 to 7 inches, just a little too large to pack comfortably with one's personal belongings. The 5 × 4 and half-plate sizes are altogether too large if one has to carry

about the outfit on anything like a long day's tramp. The ideal size of reflex to my mind is the $3\frac{1}{2} \times 2\frac{1}{2}$ inches. The square pattern, taking upright and landscape pictures, measures only about $6 \times 6 \times 5$ inches. The negatives enlarge to a given size quite as well as quarter-plates, whilst they are just the size for making lantern slides by contact.

Even the defect of bulk is not inevitable, for of

Fig. 4.

late years designers have made great progress in making the reflex as a folding camera. They have made it rapid in opening and closing, but so far (with the exception of one maker's) have not at the same time provided it with the same movements in the way of extension and rise of front to be found in the box patterns. Apart from price—the folding reflexes are more costly—my own preference is for one of the box pattern.

I know this question of cost is a serious item in the choice of a reflex. But it has its other side, because the reflex is a much more economical camera in use—economical of both plates and time. You will find the percentage of "spoils" from mistakes of focussing and errors of placing the subject enormously reduced; and it is possible also to avoid many "wasters" from under-exposure, as the reflex permits of certain focussing when a large full aperture such as f/4·5, is used. You may set this against the first cost of the camera,

Fig 5.

just as a motorist pays a high price for a car because the running expenses for fuel and repairs are proportionately lower. Not only that, the reflex is economical of time, the careful worker being able to obtain his results with the same exactness as with a stand camera and in a tenth of the time.

Coming now to the use of a reflex, the camera, whether of the box or folding pattern, is held as a rule at the level of the waist, the eyes directed down

into the hood. A camera of such weight and bulk can be held steadier than can the usual run of hand cameras, Therefore you will often find you can give a hand exposure of ¼ second, which very often is a great advantage. I am afraid makers of focal-plane shutters disregard these slow speeds in their efforts to supply speeds of an (alleged) thousandth of a second. Unless one makes a special feature of sporting subjects, such as cricket, jumping,

Fig 6.

etc., one rarely wants these ultra-short exposures, but one does often want the long hand exposures. See if the maker can adjust the shutter to give the latter at the cost of the former; if he cannot, he can very likely fit a time-exposure valve, which serves nearly the same purpose. With one or two makes of reflex a between-lens instead of a focal-plane shutter is fitted, in which case these slow speeds are available.

The first thing in making a reflex exposure is to make sure that the focussing screen is clean. You will find it is very difficult to focus properly if the screen is dusty or covered with drops of water, as it may easily be when using the camera in rain. A pocket handkerchief thrust down the hood will improve matters, but it is much better to have the hood arranged so that it turns back or pulls up to give full access to the ground glass. Some makers lay stress on the accessibility of the mirror for cleaning, but it is far more important to be able to get quickly at the focussing screen.

Very short-sighted persons sometimes find it difficult to focus easily with the screen no nearer than the mouth of the hood. These—and others who require to focus with the utmost sharpness—will derive great assistance from a pair of focussing eyepieces which can be fitted in the hood and sprung up into place for use. They fold up with the hood when closing the camera. Some people, too, are troubled by reflection from the surface of the focussing screen. In some circumstances the image is dimmed by the reflection of their own face. In this case it is better to fit the focussing screen ground side up, but the maker must make the necessary allowance for the thickness of glass.

For focussing the picture, many reflex cameras are provided with a pinion head on each side, but I advise your making a habit of using only that on the *same* side as the shutter release. I know the reverse is often put forward as the better system. They tell you that with one hand you can focus an object which is moving towards the camera, whilst the other hand is kept with the finger in readiness

to operate the release. It sounds plausible, but my experience is that it doesn't work in practice, and I have never come across a reflex user who, on cross-examination, was ready to maintain that he could work regularly on this system. No, as in using scale-focussing cameras, what you have to do is to set the focus on a certain point and wait until your moving object reaches it. This being so, it is far better to have the focussing pinion and the release on the same side of the camera and as near to each other as possible. One hand is then entirely at liberty for a firm grasp of the camera, whilst the other is used first for focussing and then for release.

In other words, don't rely too much on the reflex. Make a practice of judging for yourself how big a given object will come on the focussing screen at such and such a distance as judged by the eye. For example, you are taking photographs of sections in a march past of cavalry. From your standpoint and looking into the camera, roughly focus some mounted horseman who is at such distance as makes an image of him on the focussing screen of the size you want. Carry the distance in your mind's eye and turn the camera to the point from which the sections are coming and focus as sharply as you can on anything which happens to be at this same distance. Then, with the shutter set, you are in readiness for your subject proper. Watch it first (not in the camera) as it gets near the point you have focussed on, and finally note the image on the screen and release the shutter when it comes into sharp focus. By working in this way you will get a picture of the size you want and as dead sharp as is possible. If you try to re-focus as the subject

moves towards you, the chances are you do not get it sharp, and you are likely also to overlook having the camera properly level.

There is a special reason for thus arranging matters beforehand when taking advantage of the swing front—a movement which is often of the greatest use in a reflex camera. The lens front as a whole can be tilted, or the same movement given to the panel on which the lens is mounted; whichever it is, it is used in the same way. The front can be so adjusted that, in the case of many a subject, near and distant parts can be rendered sharply without necessity of stopping down. Suppose we are photographing from above the heads of people lining one side of a route along which a procession is coming. At the full aperture of the lens, it will not be possible to get both the procession and the foreground of heads in sharp focus. But by swinging the lens downwards the upper part of the plate (the foreground) is virtually put at a further distance from the lens, and the effect of stopping down thus obtained without the need of a longer exposure. The same method applies to other subjects where it may be necessary to swing the lens downwards or sideways. It depends on the arrangement of the subject. It is, in fact, the plan familiar to users of stand cameras, but of little service with any hand camera except a reflex, since one requires to see what the effect is before exposure.

I ought to say something about the shutter release in a reflex, although that is mainly decided by the mechanism of the mirror to which the shutter is connected. Having selected one or other of the two most general types, the user must make the

best of it, but we may bear the difference in mind when choosing an instrument of the reflex pattern. There are two systems :—(1) In which release of a spring raises the mirror without any assistance from the user other than pressure upon the release-button or trigger. The mirror remains in the up position until depressed again. (2) In which the mirror is raised by the operator's pressure upon a lever. On the pressure being removed the mirror falls again into the down position.

In the case of both patterns, the release of the focal-plane shutter follows on the raising of the mirror into the up position, but one great advantage of the spring system is a much gentler release, because free from the muscular jar which can be readily communicated when pressing down a lever through a distance, usually, of an inch or so. Another is that the spring release is more regular in action, that is to say, the minute interval of time which elapses between pressure on the release and the operation of the shutter is fixed by the mechanism, whereas with the hand-raised mirror it depends on the quickness with which the mirror is raised. Again, the hand-raising movement usually necessitates a downward thrust on the more forward portion of the camera, a form of release movement which is most liable to move the camera at the time of exposure, and this, in the worst way, since it angles the axis of the lens as regards the subject. With the spring-raised mirror the release is a very light movement, and, moreover, can be placed as a direct thrust towards the body of the operator, without tendency to shift the camera up or down or sideways. One advantage of the hand-raised

mirror is, of course, the fact that it falls again after exposure, and thus is there to cover the plate when the shutter is re-wound for a second exposure. But the advantage is more imaginary than real, since most focal-plane shutters now are self-capping, that is, do not uncover the plate during winding for the next exposure; and in the case of a non-capping shutter, there is the device of an automatic lock by which the shutter cannot be re-wound until the mirror has been put down to protect the plate. But there is a further drawback to the hand-raised and [illegible]ailing mirror, namely, that it prevents the [illegible] the camera in the upside-down position. [illegible] later paragraph to the usefulness of the [illegible] in enabling the operator to photograph over ob[illegible] of [illegible]nsiderable height, and yet to see and focus the picture. For this the mirror re[illegible] of th[illegible]ng - actuated p[illegible]

[illegible] the design of the shutter [illegible] than its top achievement [illegible] essential to be able easily to [illegible] the speed. Some shutters require to be released or only partly wound for an alteration of speed to be made—a great drawback in practice, for one often wants to increase or reduce the speed immediately before exposure. I would gladly sacrifice all the speeds above 1/150th of a second for the convenience of a rapid adjustment, either to slower or faster, of the speed. A further [illegible] feature of a shutter is its ability to be set for a given speed, and to be returned to that every time the key is wound to the full. When making exposures in quick succession it is a nuisance to have to look

every time that the shutter is wound to the correct point—no more and no less.

And while I am upon the subject of reflex construction, I may refer to one or two other points. Extension, double or single, is not of such vital importance now that we have fixed-focus large-aperture telephoto lenses, which provide a great focal length, yet require only the normal camera extension. But if you must have a double-extension it is best to choose the design which is the quickest in use, *viz.*, that with pull-out baseboard. Rise of front is ample if it is one quarter the height of the place. The movement should be by screw or rack and pinion. Sliding fronts are usually too tight or too loose, which means they are either jerky in use or require to be fixed with a set screw after every adjustment. A part of the reflex which requires to be of solid and accurate construction is the rotating back, carrying the plate-holder, and now almost always fitted in place of the loose reversing back. One or two makers fit it in connection with a rotating mask or pair of masking bars under the focussing screen. As the back is turned, the shape of the picture changes from horizontal to upright or *vice versa*. It saves one making the mistake of taking a "landscape" picture on the upright plate, but it is a quite minor convenience.

But we must return to the methods of using a reflex, and particularly to the means by which certain of the disadvantages commonly attributed to the reflex camera can be avoided.

In the usual position (Fig. 1) the reflex is certainly a more conspicuous hand camera than many others,

but it can be held in other ways which draw less attention to it. In taking photographs of figures where the photographer's aim is to work without the knowledge of his subjects, it is not a bad plan to focus on a distance which will give the figure of the required size on the plate, then to close the hood and to stalk the subject as with an ordinary box camera, having an eye to keeping at the prescribed distance. Working in this way, one can keep the camera concealed behind one and bring it instantly into operation when a favourable moment arrives. Another method is to thrust the camera under one arm, pointing it somewhat behind one, as shown in Fig. 2. You see the subject clearly on the ground glass, though the chief part of the camera is hidden. Another plan is shown in Fig. 3. The camera is simply held sideways, so that one's subject will not easily realize that the photograph is being taken in a direction exactly at right angles to that in which the photographer is himself looking. For this purpose it is a convenience for the hood to be reversible in its setting, and many reflexes are now made with this movement, the frame of the hood being square and fitting either way into the top of the camera.

An attachment to the reflex camera which should be mentioned here is a mirror fitted to the lens hood at an angle of about 45°. With it the camera is pointed straight forward, but the photograph is taken in a direction exactly to the right or left, according to the side to which the mirror is turned. In this way figure subjects can be taken at quite close quarters without any suspicion on their part. The mirror requires to be optically flat and silvered

on the surface, which is somewhat of a drawback, apart from cost, as its exposed position renders it liable to get damaged or tarnished. But much use has been made of the method, particularly in Oriental countries, where the natives have religious scruples against allowing themselves to be photographed. The negatives obtained by this means are reversed as regards right and left, but this can, of

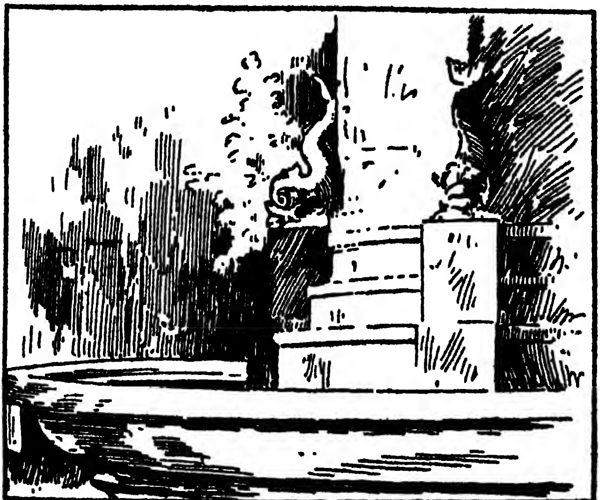


Fig. 7.

course, be put right when enlarging, or making lantern slides by reduction.

Next we come to using the camera at a somewhat higher level. One means of doing this (shown in Fig. 4) consists in the use of an extra mirror fitted either on the top of the hood, or, as in some patterns, inside the hood and viewed through an opening in the back. One can thus see and focus the reflected image of the picture on the ground glass. The worst

of this plan is that one can never see the whole picture and it is not so easy to focus exactly. Where some support can be got for the camera the plan shown in Fig. 5 is better, that is, to place the camera on its side. In this case again the reversible hood is a convenience, and the focussing pinion and shutter release require to be on the same side of the camera for this plan to be of much practical use, whilst the mirror must be of the spring-raised pattern.

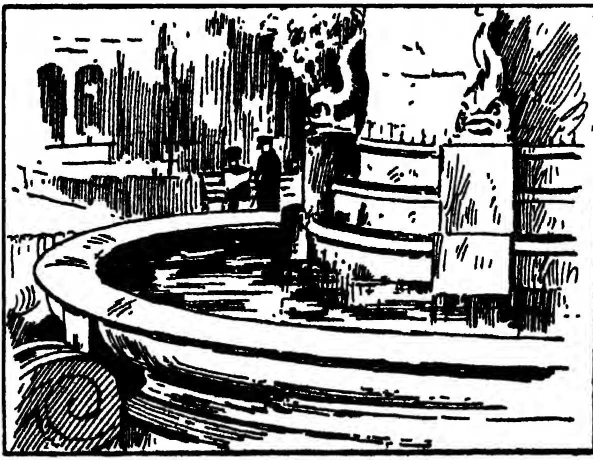


Fig. 8.

A still further method of photographing from a view-point higher than that which can be employed with any hand camera is to hold the reflex upside down at arm's length above the head, viewing and focussing the picture by looking straight up through the hood, as in Fig. 6. The camera needs to be fitted with a stout carrying handle so that it can be held with one hand whilst the other is used for focussing. Working in this way is a rather fatiguing

business, but it enables one to deal with many subjects which could be obtained in no other way. I show line drawings from a pair of comparative photographs of the Shakespeare fountain in Leicester Square. Fig. 7 is taken at the waist level; Fig. 8 (which well shows the water in the basin, and the surrounding garden), with the camera held above the head.

These hints on certain special methods of holding the reflex must not be taken as implying that they are necessary except in special circumstances. In the usual way the camera is used in a perfectly straightforward manner, much as any other hand camera is used; and anyone who adopts the reflex will rapidly forget all its alleged disadvantages in view of the wonderful assistance it affords in every form and variety of hand camera work.

PRINTING ON GASLIGHT PAPERS

(The late) C. H. HEWITT, F.R.P.S.

(Gaslight printing has become increasingly popular during recent years, and the process has a great deal to recommend it. Good methods of working it are described in the following article).

FOR the worker who wants one printing process, and only one, gaslight is the process *par excellence.* The range of papers available in regard to contrast, tone of paper and surface quality is considerable and unless a negative be very strong it is difficult to find one which will not yield a satisfactory print on one of the varieties. The process is simple and convenient in that the dark-room is not necessary and the developer employed will keep for some time after being prepared. The tendency during the last twenty years has been towards less vigorous negatives, and the manufacturers of the various sensitive papers, whether carbon, platinum or silver, have had to keep pace more or less with this tendency by adjusting their products to compensate for the lack of strength in the average negative. The gaslight process is the one best adapted for dealing with the very thin negative, and for this reason it should be at hand in every work-room, even when other processes are worked, for it is frequently simpler and better to vary the printing process in this way

than to manipulate the negative by any method of intensification.

It is generally recognised that for enlarging with oil, spirit vapour or incandescent gas as the illuminant a thin and delicate negative is essential if the best results are to be obtained. Such a negative is too thin for the best results in almost any of the printing processes except gaslight, and so the worker who wishes to make enlargements and contact prints from the same negatives and who is limited to an illuminant of comparatively low intensity in his enlarging lantern will find this process admirable for the contact work.

There is a good deal of uncertainty in the minds of many workers as to the meaning of the term "gaslight" paper, and it may be well to clear up this point to begin with. As compared with P.O.P., carbon or platinum, gaslight papers are very rapid. On the other hand, gaslight paper is very slow as compared with bromide paper. There are variations in speed with different brands of both bromide and gaslight papers, but on an average gaslight paper requires sixty times as long an exposure as does bromide. So that we may roughly estimate that where we should expose for so many seconds to make a bromide print we must give an equal number of minutes under the same conditions for a gaslight paper.

In actual practice we do not adopt the same conditions, and while it is quite convenient to expose bromide paper at a distance of about three feet from a 32-c.p. electric lamp, we should expose gaslight paper at a distance of perhaps eight inches from a 50-c.p. Osram lamp. In this way the actual duration

of the exposure for the print is brought to quite a convenient time. As, however, both bromide papers and gaslight papers are exposed to gaslight or some substitute for it, such as electric light or an oil lamp, some confusion of thought between the two papers has occurred. The fact is *gaslight paper* implies a paper which may be manipulated in gaslight instead of in a work-room illuminated by the orange or yellow light which is essential for the bromide papers. It may be wondered how it is possible to work a paper in the same light by which it is printed. Let us consider P.O.P. for a moment for an analogue. We print P.O.P. in good bright light, often in direct sunlight, and then to examine the progress of printing, or to wash, tone and fix the prints we withdraw into the more or less feeble light of the room. That is, we print in a strong light and handle the paper in a feeble one. In just the same way is a gaslight paper manipulated. The paper is so slow that, as we have briefly seen, it must be exposed behind the negative comparatively near to a fairly powerful light. Then for development and fixing we move away to a position some distance from the light, or we may produce the same effect of a considerable weakening of the light by working in the shadow of some screen, partition or shelf. As the intensity of light varies inversely as the square of the distance, we readily see that when we are developing at 12 feet distance from the light we are only getting a minute fraction of the light which we get when exposing the print at a distance of 6 inches from the source of light. To give actual figures, the paper receives 576 times as much light 6 inches from

the gas burner or electric lamp as when it is 12 feet away. From this point of view it will be fairly obvious that it is possible to expose and develop by the same *quality* of light, the difference being one of *quantity* only. But there is another important point. The time taken in development is very short, usually a matter of a few seconds, and seldom longer than thirty seconds, so that the paper is not subjected for very long even to the relatively weak light used for manipulation.

To sum up these points, we have in the gaslight printing process a method capable of yielding beautiful results from negatives too thin and weak to print in other processes, as well as from all average negatives, and a method which may be employed in an ordinary room. It is a quickly worked process, it being an easy matter to run off a couple of dozen prints from as many negatives in an hour or an hour and a half. Slight differences in the negatives may be compensated by the choice of the paper, and the Barnet "Bar-Gas" is made in two different speeds, the more rapid brand giving softer results and the slower one prints which are more brilliant or plucky.

TYPE OF NEGATIVE AND VARIETIES OF PAPER.

Let us now go into the working details, and as in making a print one must always start with a negative we may consider the characteristics of the negative first. As we have suggested, the process is admirably adapted for negatives which are inclined to be somewhat weak, but it should be understood that we do not suggest that

any bad negative may be made to yield fine results. As with every other process the best prints will be yielded by good and suitable negatives. A properly exposed and softly developed negative is ideal, the sort of negative which will yield a print on P.O.P. which is just inclined to be rather flat, dull or muddy. A good way of testing a negative is to lay it film side down on some printed matter when black letters about an eighth of an inch in height should be just legible through the densest portion, assuming that the shadows are almost, but not quite, clear glass. If the type is seen very plainly the negative is thin enough to require one of the slower gaslight papers, those usually termed *vigorous*, while if the high-lights of the negative almost obliterate the type, then one of the more rapid papers should be selected, one of those designated *soft*. Some such test as this will be found more reliable than an examination of the negative when held up to the light, especially when one is commencing to work the process.

The colour of the negative has a powerful effect on its printing strength, and we are assuming a clean, grey image, such as that produced by Rytol, Azol, Rodinal or others of the clean-working developers. If the plate has been developed with pyro-soda and care has not been taken to avoid yellow stain by the use of sufficient sodium sulphite and of a suitable acid fixing bath, a pronounced yellow stain may occur. Such a stain may not prevent the type being visible in the way mentioned above, but it will considerably increase the effective density of the negative. The simplest way, of course is to avoid producing the stain.

Negatives which are harsh are difficult to manage and it is not possible to obtain decent results from such unless a very intense illuminant is at hand. Possibly the best light in such cases is a small length of magnesium ribbon or wire, held by means of a pair of pliers or tweezers and ignited at a spirit lamp or Bunsen burner, the blue flame of either of these having no effect on the gaslight paper. This intensely powerful light penetrates the density of the negative in a way that no weaker light acting for a longer time will do.

We have already alluded to the great variety of papers available, and advantage may be taken of this variety to suit both the negative and the character of the subject. There are two speeds of Barnet "Bar-Gas," the *vigorous*, which is the slower, and the *soft*, which is the more rapid. But in addition to these varieties influencing the contrast of the print from any given negative, something may be done by choice of surface and tone of paper. Thus a smooth paper gives rather more contrast than a rough one, and a white paper rather more than a toned (*i.e.*, usually cream) one. Glossy papers are better for subjects in which the rendering of detail is important. Cream papers are usually of advantage for rendering sunlight effects or for strong effects in portraiture. In many cases the choice of surface is not very material and will be a matter of individual preference. The art surface is made in both grades, vigorous and soft, and has a semi-matt surface which is very pleasing. The matt surface is also supplied vigorous and soft, and is a dead matt paper. Glossy vigorous and glossy soft both have a brilliant surface which may be left

as it is, or still further enamelled by squeegeeing and stripping from ferrotype plates or plate glass. The cream paper is made with a semi-matt surface, which has a slight satiny sheen that is very charming.

SOLUTIONS FOR WORKING, AND GENERAL METHODS.

For convenience in working, especially if rapidity is an important consideration, certain points should be observed in the arrangement of lights, dishes and so on, and every care should be given to the preparation of the solutions. Simple as the process of making a print on gaslight paper is, trouble will ensue if proper care is not taken. Indeed, it is safe to say that the more trouble is taken to carry out instructions exactly, the less trouble will be found in producing perfect prints. Either the well-known M.Q. developer or amidol may be used, our own preference being for the M.Q., if for no other reason than that it keeps better when mixed up, the amidol solution only lasting a day or two in hot weather and three days at most in the cooler parts of the year. The formulæ, which are easily made up, are as follows :—

METOL-HYDROQUINONE DEVELOPER.

Water	10 ozs.		300 ccs.
Metol..	8 grs.		·5 gram.
Hydrokinone (Quinol) ..	30 grs.		2·0 grams.
Soda sulphite	300 grs.		22·5 „
Soda carbonate	350 grs.		20·0 „
Potassium bromide.. ..	3 grs.		0·2

The ingredients should be dissolved in the order named.

AMIDOL DEVELOPER.

Amidol	100 grs.		5·5 grams.
Soda sulphite	2½ ozs.		55·0 „
Potassium bromide ..	4 grs.	or	0·2 „
Water	1 pint		500 ccs.

This developer will keep only three days.

These solutions are the proper working strength for any of the vigorous papers while for the soft papers they should be diluted with an equal bulk of water. It must be remembered, however, that an excess of bromide in the developer tends to produce brownish or greenish colour and that for pure cold black tones the minimum of bromide is necessary. On the other hand, if the bromide is cut down much the paper may fog when it is being used in an ordinary room illuminated by white light, particularly if one's methods are deliberate and the paper is exposed somewhat incautiously to the light. We have found, however, that with the developing solutions made up exactly to the above formulæ the colour of the prints is all that can be desired when correct exposures are given. Still some workers prefer to omit the bromide entirely, keeping it as a separate 10 per cent. solution, and adding a few drops to the working developer as may be required. When doing so it is well to remember that ten drops of the bromide solution contain practically one grain of potassium bromide.

For fixing the prints a plain hypo bath of 3 ozs. hypo to 1 pint of water may be used, but it is much better to use the following acid fixing bath :—

Water	64 ozs.	or	1,000 ccs.
Hypo	16 ozs.		250 grams.

When dissolved add the following hardening solution.

Water	5 ozs.	or	78 ccs.
Sulphite Soda	1 oz.		15 grams.
Glacial acetic acid ..	$1\frac{1}{2}$ ozs.		25 ccs.
Powdered alum	$\frac{1}{4}$ oz.		7·5 grams.

This bath has a strong hardening effect on the gelatine, which in hot climates or when the weather

Frost on Fir-Trees

(J. G. Newmarch)

is very warm is of advantage. Prints fixed in this bath can have the surface water blotted off with blotting-paper, and can be dried at a very high temperature. It also does not discolour with use.

When using fixing baths that do not discolour care must be taken not to keep them in use too long, as the hypo can be exhausted without there being any visible change in the bath.

We have already alluded to the great convenience gaslight papers afford in that no dark-room is necessary, and as will be recognised in conjunction with tank development of spool films, they enable all the operations of photography to be completed without any special dark-room, and, with the exception of exposing the films or plates in the camera, without the necessity for daylight. At the same time the worker who has a convenient work-room at his disposal will find that he can work more rapidly and with certain other minor advantages if he employs a bright yellow or pale chromium green glass in front of his developing light. More light may actually be used, while the risk of fog is absolutely nil. Such a light, of a square foot in area, will illuminate the sink and work bench admirably.

The exposing light should be so arranged that the printing frame or frames may be set on some rest, both to secure a uniform distance from negative to light, and so uniform prints, and to avoid the fatigue of holding the frame during the comparatively long exposures. We have found that with a 50-c.p. metallic filament electric lamp, exposures with a suitable negative are about 15 to 20 seconds at a distance of 6 inches when using the vigorous

(*i.e.*, the slow) papers. The soft working papers only require about a quarter of this time. An incandescent gaslight with a reasonably new mantle gives a light of about equal candle power. A duplex paraffin lamp, giving a yellow light, necessitates a longer exposure, possibly as much as a couple of minutes being required.

The distance at which the printing frame is placed from the light will naturally depend on the size of the negative. Six inches is satisfactory for negatives up to and including quarter-plate, but above that size the diagonal of the negative should be accepted as the minimum distance. The reason for this is that if placed too near to the light the centre of the negative receives much more illumination than the corners and a kind of vignetted effect results. This effect is in some cases an advantage, as, for example, with portrait heads when background and dress are white or very light in tone. The vignetting effect is soft and delicate and does not pass to absolutely white paper at the edges of the print. Of course, with such a light as a 50-c.p. Osram lamp the area of the illuminant is considerable, and so good distribution occurs over any negative up to half-plate.

Some workers prefer to expose by means of magnesium wire or ribbon, and if this method is employed it is preferable to use a constant light, that is to burn always the same length of ribbon, say, an inch. We have already indicated the method of holding and igniting the ribbon. To adjust exposure in relation to the density of the negative the distance from the burning magnesium ribbon to the frame will be varied. The following

table has been given, burning in each case one inch of ribbon.

For a dense negative	12 inches from the printing frame.				
„ normal „	24	„	„	„	
„ medium „	30	„	„	„	
„ thin „	40	„	„	„	

It must never be forgotten in printing that the exposure increases as the square of the distance from the light to the negative. Thus, if exposure at 1 foot distance is a minute it will be *four minutes* at a distance of 2 feet. If for any reason we exposed at 4 feet distance from the lamp, the exposure would be 4 squared, *i.e.*, 16 minutes. There would be no reason for placing the frame at as great a distance as 4 feet, unless indeed the negative were a mere ghost of an image.

Having the solutions, dishes, printing arrangements and so on, in order, we may proceed to open the packet of papers and make a print. If we are working in gaslight or electric light we shall preferably stand with our back to the light, and so handle the paper in the shadow of the body. On the other hand, if employing a yellow or pale green light, we may handle the paper in the full light. There is no difficulty in deciding which is the coated or sensitive side of the paper, for it always curls slightly inwards, the hollow or concave surface being the sensitive one. A sheet may be cut into strips, say, about an inch in width, and one of these laid across the negative so that any portion of the strip will include a representative part of the negative. With some subjects this is not possible, and then it is well to use a strip of somewhat greater width. In exceptional cases, or where a very perfect print is desired, a test strip may be used first in order

to get near the correct exposure, and then one or two full-sized prints may be made with slight variations in exposure, and possibly with some shading to hold back certain portions.

The exposure made, the print should be wetted in cold water. Time is saved if a large dish half full of water is at hand, and the print may be just dipped into this for a moment and then laid face upwards in the developing dish and a small quantity of developer poured over it. The image should appear almost at once, and should be completely up in from ten to fifteen seconds. Any prolongation of development, particularly with the vigorous variety of paper will be very prone to produce staining. Equally the use of stale developer will produce stains. We have used the same two ounces of M.Q. for eight times in succession in order to ascertain how far one might safely go, and found no tendency to stain, but in each case the print was properly exposed and development not in the least forced. Ordinarily it would be preferable to use half the quantity of developer and to develop not more than two or three prints in it.

After the image is dark enough the print must be rinsed to remove the developer and placed in the fixing bath, where it should be kept moving for at least a few seconds. The exposure is usually to be adjusted so that the print will develop up and go no further than desired, but it should be on the full side, and it is often necessary to remove the print quickly and rinse and fix without delay. Particularly when a vigorous print is required from a rather flat negative must the exposure be full and the development arrested in this way. A somewhat

short exposure and longer development will usually give a softer result, but the danger zone of fog or stain is very near and will often be reached. Stains and other defects will be further dealt with later.

Any control of the print which may be required during printing may be readily done when using any of the ordinary illuminants. The distance from light to frame may be adjusted so as to give sufficient time for this shading. Parts which are dense in the negative may be printed up by cutting a small hole in a card and allowing a pencil of light to fall on the required part. Control is not so easy when working with magnesium ribbon. When one side of the negative requires longer exposure than the other the frame may be set obliquely, that is, with one side on end nearer to the light. The shading effect is then produced more regularly than it would be by actual shading of the less dense side by a piece of card. This tilting of the frame is often useful when a sky needs just a little more exposure in order to show the clouds.

As each print is fixed, the other prints in the hypo bath should be moved and turned over, and those which have been fixing for fifteen minutes may be removed and placed in a dish of clean cold water. When all the batch are finished washing may be proceeded with. We think no method of washing so good as that of changing the prints by hand from one flat porcelain dish to another, filling the dishes alternately and removing the prints one by one, allowing a moment for each print to drain before placing it in the fresh lot of clean water. Prints so washed are invariably brighter and cleaner and have an absence of kinks and

creases, and they are in addition more completely freed from hypo than if they were washed in many of the so-called automatic washers.

Gaslight prints dry more rapidly than do P.O.P. or bromides. If the alum-acid-hypo bath is used heat may be employed in drying. It is usually safe to use gentle heat if the prints are exposed to a current of air at the same time. For example, a print held still in front of a fire or over a gas-ring may melt, while if it is kept waving about it will dry without any softening of the film. When prints are wanted very quickly, as, for example, for press purposes, they may quite safely be dried in alcohol. Five minutes washing as suggested would be sufficient and the print might then be blotted off and placed for two or three minutes in spirits of wine, again blotted off in dry blotting paper and dried by waving it about in a warm room. There is little or no risk of the print catching fire if it is waved in front of the fire, so long as the blotting off has been carefully done, and, of course, the spirit will be kept well away from fire or gas-ring. To treat prints in this way is undoubtedly to risk permanence, but for press work permanence is not required, but rapidity of output.

If prints required in an ordinary way are to be blotted off, either a specially prepared photographic blotting-paper should be used, or some well-washed fabric of an absorbent nature.

ENLARGING ON GASLIGHT PAPERS.

Where negatives prove too flat to give good enlargements on bromide papers, even of the slower varieties, satisfactory results may often be

obtained on gaslight paper. It is usually necessary to use the vigorous brands and on no account must the exposure be curtailed, or all the troubles of staining in development and fogging of the lights will be incurred. The method is only a practicable one when a fairly powerful illuminant is available, such as acetylene or one of the many small arc lamps which can so conveniently be run from an ordinary lamp holder. An anastigmat lens with a large aperture is also desirable, for the more the exposure of the paper is prolonged the greater the risk of fog from stray light in the dark-room. Obviously such enlarging would need to be done in a room with some safe yellow or chromium green lighting, for the paper is fully exposed on the enlarging easel for a comparatively long time and would be completely fogged if so exposed in a room with ordinary illumination.

DEFECTS, DIFFICULTIES AND SPECIAL PRECAUTIONS.

Probably the commonest defect found in gaslight prints is the pinky brown stain which is due to prolongation of development following on under-exposure of the print. Obviously the way to avoid this is to expose fully and shorten development. Another kind of stain is the yellowish stain which occurs when prints are not washed, or are insufficiently washed, after development and before fixing. These are due to the formation of silver sulphite and silver sulphide, and are not susceptible of removal. The leaving of prints in the fixing bath without constant turning over will often produce stains, especially when the prints have been

imperfectly washed after development. The greatest cleanliness is necessary in handling the paper and the solutions. Dishes and measures must be scrupulously clean and should be cleaned before use with a little dilute hydrochloric acid. While care must be taken to avoid carrying traces of developer into the fixing bath, equal, if not greater care, must be taken to avoid contamination of the developer by hypo. If prints are placed in the hypo and turned over by hand the hands must be thoroughly washed before proceeding with the next print. To avoid this trouble every time it is an advantage to have an assistant to take charge of the fixing, and if this cannot be arranged and the prints are small, they may be tucked under the fixing solution and kept moving for a few moments with a strip of thin wood shaped something like a paper knife.

If the colour of the prints is greenish it is an indication that the developer contains too much potassium bromide; on the other hand, if the high-lights appear fogged, *i.e.*, grey—not stained pink or yellow—it is an indication of insufficient bromide.

Avoid using the developer for too great a number of prints. As the print should always be wetted before development and will thus lie flat on the bottom of the dish, a small bulk of developer will be sufficient to cover it. It has been suggested that the developer be applied to the wet print with a flat, soft bear's-hair brush, and we have used this method of development with success. A sheet of glass may be rested in a dish and sloped steeply upwards like a desk. On this the soaked print is

laid and the brush dipped into the developer and brushed over the print in even sweeps. There is not, however, much economy of developer when using this method, and it probably occupies rather more time than does dish development.

The temperature of the solutions is important. In hot weather it is well to cool both the developer and the fixing bath with ice and there is no harm in adding a small piece of ice to the solutions, for though it will slightly weaken them this will do no harm. The solutions should not be cooled below 50° or 55° Fahrenheit, so that very small additions of ice will be ample.

CLEANING UP PRINTS.

A defect which sometimes gives rise to a good deal of trouble makes itself apparent in dirty markings or "pencil" markings on the light portions of the prints. Some papers are more subject to this than others. These marks are most troublesome in vignettes or in masked prints where perfect purity of white is essential. Paper which has been in stock some time and has been carelessly handled or subject to pressure in packing and transit will usually show these stress markings to a greater extent. If the sheets of paper are taken out of the packets at all roughly or carelessly the marks will be obtained, and it sometimes is quite enough to rub the edge of one sheet against the surface of another. Various methods of removing the marks may be tried. We have found the following satisfactory. Add a few drops of a 10 per cent. solution of potassium ferricyanide to a few ounces of a 5 per cent. solution hypo and quickly mop this over the print

with a tuft of medicated cotton wool. Of course, this is a reducer, and if allowed to act too long will eat away the delicate tones. The print may be laid on a sheet of glass or on the bottom of an upturned porcelain dish. It should be rinsed under the tap almost immediately. Of course, the solution may be applied more freely to the perfectly white margins for there is nothing there to remove except the undesired stress marks.

A method which may be employed when the prints are dry is to rub very gently with a small tuft of cotton wool moistened with alcohol. This method, however, usually leaves a slightly dulled patch on glossy or semi-matt papers, and in any case is apt to leave a smeariness on the print.

TONING GASLIGHT PRINTS.

The same methods adopted for toning bromide prints may also be applied, in most cases to gaslight papers. As a rule, however, the pure blacks and greys of Barnet "Bar-Gas" prints are preferred to any other tones, by reason of their pleasing effect.

DRYING, MOUNTING AND FINISHING OFF.

When the prints are washed they should be dried quickly, for slow drying causes a certain amount of deterioration and allows them to pick up dust and dirt. They should, however, not be dried anywhere near an open fire, because tiny particles of ash and particularly of coke ash may settle on them, and doing so will bleach tiny spots. Except in hot weather and even then if an acid-alum-hypo fixing bath has been used, the prints may be blotted off

and laid on a clean towel, face upwards, when they will rapidly dry. If a cord or wire be stretched across the work-room the blotted prints may be hung up to this by means of the little clips sold as American clothes pegs. A few deep wooden frames with clean tapes stretched across make excellent rests for prints when drying. As we have already suggested, prints may be dried in alcohol, the only difficulty being to find alcohol uncontaminated with mineral naphtha at a moderate price.

Glossy papers may be dried after being squeegeed into contact with ferrotype plates or pulp slabs, and this is an excellent way of finishing post-cards. The cards strip off when perfectly dry with great ease and lie much flatter than they can be got in any other way. The ferrotype plates or pulp slabs should be rubbed over with a trace of olive oil and then have this polished almost completely off. Squeegeeing should not be done directly on the back of the picture or the paper will be roughened, but a sheet of rubber cloth or American leather cloth should be laid down and the squeegee applied vigorously on that.

Mounting may be done in the ordinary way, either wet or dry, with any suitable photographic mountants or by the shellac dry mounting methods. Many of the papers may be spotted with a finely pointed pencil, especially the semi-matt and art surfaces, where the slight shine of the pencil is not noticeable on the satiny surface of the print. Ordinary charcoal grey water colour may be used with a sable pencil, the glaze of the print being matched by the addition of a little sugar or gum to the colour.

As most of the papers are characterized by a delicacy and daintiness of surface and effect every care should be taken to completely conceal any spotting and touching up, and the trimming and mounting should be carefully considered so that the whole *ensemble* may be in harmony with the surface and delicacy of the print. The papers of heavier substance are admirable for stronger and bolder effects, and will readily bear treating more vigorously when the scheme of mounting is being considered.

P.O.P. and SELF-TONING PAPER

By

HENRY W. BENNETT, F.R.P.S.

(Mr. Bennett is a well-known expert on many technical photographic subjects, and offers here full information on the successful working of two useful printing processes).

ALTHOUGH printing-out paper is by some regarded as the beginner's process, there is no reason why it should be considered as suitable for elementary workers only. It possesses qualities that distinguish it from all other printing processes and render it specially suited for certain work.

One special distinguishing quality of this process is that which gives it its name. The image is produced in its full strength by simple exposure to daylight, without the necessity for development, as in other printing processes, and this renders printing-out paper very useful for those subjects that require controlling or double-printing, as well as for technical work and many subjects of special character in which strength and fine rendering of detail and gradation are important. Those two points, rendering of gradation and fine detail, are distinct characteristics of printing-out papers. But the one outstanding feature, the one strong point of the process, is the strong image that is produced in the printing frame ; by means of which the progress of printing can be carefully watched, and stopped at the right moment, and all modifications effected and gauged

correctly, as their full effect can be seen during the progress of the work.

A second advantage of this process is the natural result of the quality just described. As the image is produced by direct exposure of the paper to daylight, it follows that all the working of the process may be carried out in subdued daylight or in any artificial light; the use of a dark-room is not necessary. Working under these conditions enables the photographer to gauge every operation by the appearance of the strong image, and, consequently, obtain with certainty the result that he requires. This, to the inexperienced or occasional worker is far easier than working in the dark-room.

A brief outline of the working of P.O.P. will render the detailed description of the various operations more easy to follow.

Barnet printing-out paper is a paper coated with gelatine containing chloride of silver in chemical combination with the gelatine. By exposure to daylight under a negative, a strong purple or purple-brown image is produced. This image requires fixing, as the operation of dissolving out the silver salt that has not been utilized in forming the image is called. This silver salt remains practically unchanged in the lightest parts of the picture, and to a greater or lesser degree in the medium tones. If it were not removed the whole surface of the print would darken by exposure to light until it became as dark as the deepest shadow.

In addition to dissolving and removing all the sensitive silver salts that are no longer required, the operation of fixing introduces two important changes. The image changes in colour from a rich

purple brown to a weak, disagreeable yellow brown; and simultaneously loses considerably in strength.

The second of these changes, the reduction in strength, can be easily compensated by continuing the printing until the image is distinctly darker than it is required to be when finished; the reduction in the fixing bath will then leave it sufficiently strong to be satisfactory. The alteration in colour must be rectified by an additional operation, called toning. The most common method of toning is by immersing the print, before fixing in a solution of an alkaline salt of gold which changes the colour to a rich purple-brown or purple, the warmth or coldness of the colour depending on the composition and strength of the toning bath.

After fixing, the only essential operation is washing to remove the fixing salts that still remain in the paper and gelatine film.

Barnet P.O.P. is made in several varieties. Glossy, the kind most frequently employed, possesses the highly glazed surface that is usually associated with P.O.P. It is this surface that assists so much in giving force to the image and in rendering detail and gradation so exquisitely. A second variety, the matt, is not so extensively adopted as it deserves to be. It has not the dead surface so frequently found in matt papers, but it possesses a slight sheen, scarcely sufficient to remove it from the true matt surface, but which still has the property of preventing the weak, dead, sunk-in appearance of the shadows, which is an inseparable attribute of an absolutely matt surface. This slight sheen imparts depth, transparency and richness to the shadows of a print, and prevents the shadow details from

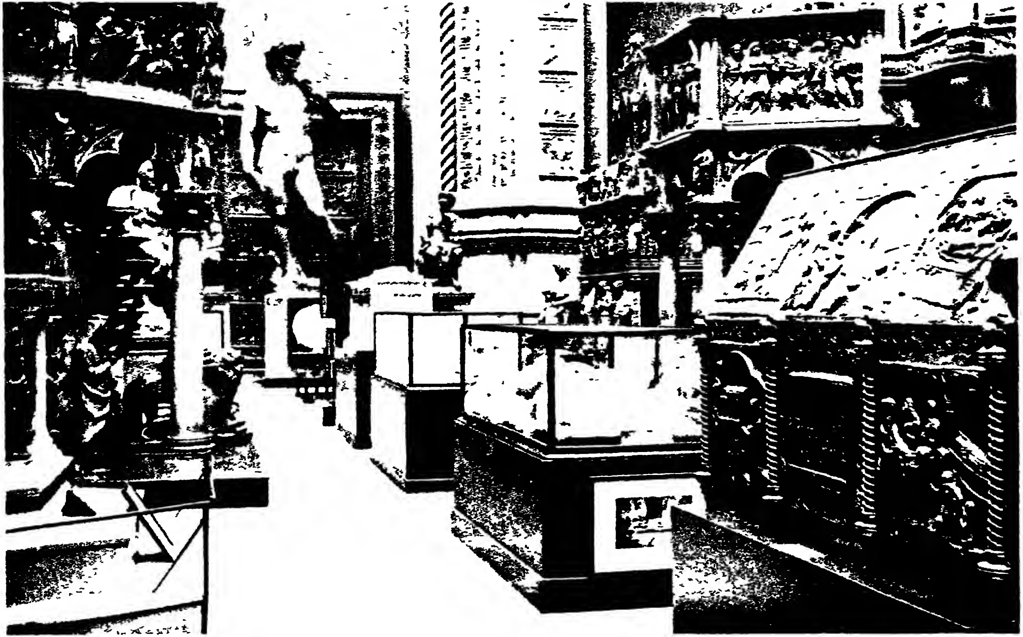
becoming blocked up. Prints on this paper have a charming rich quality distinctive in character and quite different from those on the ordinary glossy P.O.P.

Another variety, which is also prepared with both glossy and matt surfaces, is the Barnet Self-toning paper "Bar-Tona." This, as its name implies has the gold necessary for toning incorporated with the sensitive salts, so that, after printing, fixing is the only operation necessary. After simple fixing in hypo, the prints are a pleasing purple-brown.

In giving detailed instructions for working any photographic process, the description always appears to be more complex than the work actually becomes in practice, and P.O.P. is no exception to this rule. It simply arises from the fact that precautions that would be taken instinctively, almost unconsciously, seem elaborate when described, though when working they are scarcely noticeable. At the same time, it should be recognised that all the precautions advised are essential for the successful working of P.O.P. All the methods advocated are the result of successful systematic work.

STORING THE PAPER.

The paper, when purchased, is packed flat, between pieces of card, and wrapped in semi-waterproof paper, which is a very efficient protection. An excellent method of storing is to place the P.O.P., still wrapped in the waterproof paper, in a plate box, putting two or three old negatives, from which the film has been removed, on the top of the paper.



INTERIOR—SOUTH KENSINGTON MUSEUM

HANDLING THE PAPER AND FILLING THE PRINTING FRAMES.

The negatives, like the paper, must be perfectly dry when the frames are filled for printing. Any dampness, either in the negative or the printing paper will cause the two to stick together, and ruin the plate. The silver in the paper will cause stains on the surface of the negative, stains that appear metallic by reflected light and red by transmitted light. If these stains are discovered at once, and they are only slight, they may be removed by rubbing the surface of the negative with a piece of soft rag moistened with methylated spirit. If they are serious, or if they have been allowed to remain long without attempting to remove them, they cannot be removed without serious injury to the negative.

The box containing the paper should be opened and the frames filled in a weak light. In an ordinary room, a table as far from the window as possible, or away from the direct rays of light; will answer well if the sun is not shining on the window. In the summer time, when the light is powerful, especially if the sun is shining directly on the window, the precaution of drawing down the blind should be taken. A slight degradation of the purity of the paper must necessarily result from exposing it too freely to light. And, though the darkening may be so slight as to be imperceptible when it is taking place so slowly, it is certainly degrading the light tones of the print and ruining its quality.

When practicable, printing should be done out

of doors, in the best diffused light obtainable. Direct sunshine should be avoided in summer time, though in winter it will be very useful in rendering it possible to obtain prints when the task would be quite hopeless in diffused light. The best position for the printing frame is horizontal, as this makes shielding or controlling more simple and convenient. Printing may require from half an hour to several hours, according to the negative and the quality of the light.

The time of printing must be determined solely by examining the print from time to time. This examination must take place under the same conditions as filling the frames, in a corner of a room as far from the window as practicable, and the same care must be exercised to prevent too much light falling on the print, and also to avoid breathing on it, which would naturally be a source of dampness.

Printing must be allowed to continue until the print is decidedly darker than it is required to be when finished.

As the prints are finished, they should be taken from the frames and stored in the same manner as advised for the paper before printing. It is not desirable to keep the prints very long before toning them; the best results are obtained by toning within two or three days after printing.

TONING.

The first operation is washing the prints to remove as much as possible of the excess of silver that is necessary in a printing-out paper. Without this excess it would not be possible to obtain a vigorous

and satisfactory image. Two dishes are necessary for this preliminary washing, and, with reasonable care in washing them, these two dishes will be sufficient for the complete series of operations, provided that only ten or twelve prints are being toned. Porcelain dishes should be used for all photographic work, as they are easily kept clean, and by means of careful washing the same dishes may be used for any purpose required.

One of the dishes should be filled with water, and the prints taken, one at a time, and immersed in the water. Each print should be immersed face upwards, and after remaining for a few seconds turned face downwards. Care must be taken to cover each print thoroughly with water before the next is introduced, but it is very important to avoid pressing a print into contact with the bottom of the dish or another print. It is also important to examine each print before turning it to ascertain if there are any small air bubbles clinging to the surface. If there are any they should be broken by touching gently with the tip of the finger.

As soon as all the prints have been immersed, the lowest one, *i.e.*, that which was put into the water first, should be taken out and placed in the second dish, and each one in turn, draining it as it is lifted from the water, until all are in the second dish. Then the first dish should be emptied and well-rinsed, then filled with water and the prints taken from the second dish, one at a time, draining each as it is taken out, and placed again in the first dish.

This changing from one dish to fresh water in the other is the most efficient method of washing. It

should be continued for about twenty minutes, the changes being made at intervals of about four minutes, excepting the first two changes, which should be made as quickly as possible, the print immersed first being withdrawn as soon as the last is immersed. It is important that the prints should remain in the first two washing waters as little time as possible.

While the prints are being washed, the toning bath should be prepared. The components of the bath should be in the form of stock solutions which will keep indefinitely.

No. 1

Ammonium sulphocyanide ..	1 ounce	or	10 grammes.
Water, sufficient to make ..	11 ounces		120 c.cs.

No 2.

Gold chloride	15 grains	or	1 gramme
Water	3½ ounces		100 c.cs.

To prepare the toning bath, take

No 1	¼ ounce (120 minims)	or	6.25 c.cs.
Water	8 ounces		200 c.cs.
No 2	¼ ounce (120 minims)		6.25 c.cs.

It is essential that the solutions be mixed in the order given: No. 1 added to the quantity of water specified, and No. 2 then added slowly.

This quantity is sufficient for sixteen quarter-plates or a proportionate number of other sizes. For a smaller or larger number, proportionate quantities should be taken; for example, for eight quarter-plate prints, 60 minims of No. 1, four ounces of water and 60 minims of No. 2. Sufficient toning solution should be prepared for the number of prints to be toned; it should be used once and then thrown away.

The prints are taken from the washing water, one at a time, and immersed in the toning bath. It is desirable to get them all in the solution as quickly as possible; if too long an interval elapses between the first and the last, those put in the toning bath first will tone more quickly than the later ones, and become colder in colour.

Toning may take from four to ten minutes, according to the temperature and the colour desired. When the prints are first immersed in the toning solution, they change at once to a yellow-brown. Then they rapidly become a deeper and more pleasing brown and then slowly change to a purple-brown and finally to a rich purple. During the operation of toning the prints must be continually changed in position and kept in motion. The most [illegible] movement and [illegible] satisfactory method is to take the [illegible] print and place it face upwards on top; then after a few seconds, it is turned face downwards and the [illegible] now the lowest is brought to the [illegible] manner. This movement from the [illegible] to the top [illegible] continued during the whole time [illegible] in the toning bath, the dish being frequently rocked. It is very important that the toning solution should have free access to the surface of each print, and that the solution in contact with each print should be constantly changed. As each print attains the colour desired, it is withdrawn from the toning bath and put in clean water in the other dish. When all are toned they are washed in three or four changes of water, and then fixed.

The most satisfactory fixing bath for printing

out paper is hyposulphite of soda rendered slightly alkaline by the addition of ammonia.

A stock solution should be prepared—

Hyposulphite of soda ..	1 pound	or	250 grammes.
Strongest ammonia	35 minims		1 c.c.
Water, sufficient to make	32 ounces		500 c.cs.

The solution is prepared by dissolving the hypo in the smallest possible quantity of warm water, and then making up the solution to 32 ounces. When it is cold, the ammonia should be added. If this is stored in a well-corked bottle it will keep in perfect condition for a very long time. The addition of ammonia to the solution of hypo is very important for all printing-out papers. Hypo rendered alkaline by the addition of ammonia is distinctly different from hypo rendered alkaline by other substances. Prints fixed in this solution are slightly different and better in colour in the white parts, and thus retain their purity of colour for a very long time.

The actual fixing bath is prepared by taking

Stock hypo solution	1 ounce	or	30 c.cs.
Water	2 ounces		60 c.cs.

This quantity should be allowed for every six or eight prints, and, like the toning bath, it should be used once and then thrown away.

It is essential that the prints remain in the fixing bath for fifteen minutes, at a temperature of sixty degrees, and also that, while fixing, they should be frequently changed in position in the same manner as during toning, and the dish frequently rocked. It is of the greatest importance that prints should not cling together during fixing, and that the solution should have free access to their surfaces.

As soon as the prints are fixed, and this can only be determined by the time that they remain in the solution, as there is no visible change, they should be lifted from the fixing bath, one at a time, drained and put in a dish of water. As soon as all are in the water, they should be removed one at a time to a second dish of water, and then as soon as the first dish can be rinsed and re-filled, they should be transferred to a third quantity of water.

It is very desirable that the first three changes after removing the prints from the fixing bath should be made in quick succession. A large proportion of the hypo is removed in these first few washings, and after these, the washing may proceed more slowly. This method of washing by changing the prints from one dish to another is one of the most satisfactory; it is far more efficacious in removing the hypo from the prints than the more frequent plan of leaving them in running water. If each print is carefully drained for a few seconds as it is lifted from one dish before being placed in fresh water in the second dish, the washing will be very efficient. Two dishes only are required for twenty-five or thirty prints, and by changing them in this manner about every five minutes, after the first two or three changes, they should be satisfactorily washed in an hour and a quarter. With less frequent changes or a large number of prints in comparatively little water, a longer time will necessarily be required. When sufficiently washed, the prints should be carefully drained and laid face upwards on a clean towel, in a well-ventilated room, free from dust, until they are quite dry.

During drying, which will require two or three

hours, or much longer in damp weather, nothing must be allowed to touch the surface of the prints.

BAR-TONA.

(Self-Toning Paper).

A variety of Barnet P.O.P. is prepared in which the salts necessary for toning are incorporated in the emulsion of gelatine and silver salts with which the paper is coated. When using this paper, no toning bath is required ; the prints are placed direct in the fixing bath and allowed to remain from seven to fifteen minutes, according to the tone desired, the usual moving and changing position being very necessary in order to ensure even toning. The fixing bath should be at a temperature of 60-65° F., lower temperature requiring longer to complete the process, and regularity of tone being uneven.

A good variety of tones is secured, from sepia to a plum blue, or purple, by regulating the strength of the bath, and varying the time they are allowed to remain in same, but it must be understood that in no case should they be removed under seven minutes.

After fixing, the prints are placed in cold water and well rinsed to get rid of the fixing solution, which, if allowed to remain in contact, will continue toning locally, thereby producing uneven tones, and, further, bad colours.

Fixing and toning must in all cases be carried out without previous washing, and when warm tones are desired, the bath strength recommended is as follows, allowing from 7 to 15 minutes for fixation—

Hypo	4 ozs	or	200 grams.
Water	20 ,,		1000 c.cs.

Deeper or " Plum " tones are obtained by using a stronger fixing bath, and prints should remain in from 7 to 15 minutes—

Hypo	6 ozs.	or	300 grams.
Water	20 ,,		1000 c.cs

Cold tones are obtained by using a strong bath, and prints should remain in from 5 to 10 minutes—

Hypo	8 ozs.	or	400 grams.
Water	20 ozs		1000 c.cs.

The amount of hypo solution to be used must be in correct proportion to the number of prints, otherwise the right tone will not be obtained. The proportion is—

	1 ounce of Hypo Solution to tone	1	Half-Plate Print.
or	1 ,, ,, ,, ,,	2	$4\frac{1}{4} \times 3\frac{1}{4}$ prints.
or	10 ,, ,, ,, ,,	10	Half-Plate ,,
or	10 ,, ,, ,, ,,	20	$4\frac{1}{4} \times 3\frac{1}{4}$,,

A convenient number of prints can be placed in the hypo solution together. After use the fixing bath must be thrown away, and fresh baths must be used for further prints. During fixing it is essential to keep the prints on the move, otherwise uneven tones will result. The temperature of fixing bath should be between 60°—65° F.

After fixing wash well and frequently change water; the time of washing should be about 45 minutes.

The remaining operations are those already described.

In all gelatine printing-out papers it is necessary after having fixed and washed that the prints should be hardened, as the gelatine, especially in warm weather, is liable to become soft and tacky, and therefore the surface may be easily damaged.

The hardening is quite a simple process and can

be carried out by immersing the prints in a bath of formalin, the strength of which should be one part of formaline in ten parts of water.

Other baths suitable for this process are Potash Alum 10% solution, or Chrome Alum, 5%.

The prints should be allowed to remain in any of the foregoing baths for five minutes, moving frequently, and then washed for half-an-hour, when they may be " blotted off " and are ready for drying. Prints as treated can be easily wet mounted without fear of the surfaces becoming tacky.

DRYING P.O.P. PRINTS WITH A HIGHLY GLOSSY SURFACE.

A very fine gloss may be produced on P.O.P. prints by drying them on glass or a ferrotype plate. The latter is far preferable as no preparation of the plate is necessary beyond washing it in plain warm water and then polishing it with a soft cloth.

The prints should be dried after fixing and washing and then re-wetted for putting on the ferrotype plate. The plate is laid face upwards on a convenient firm board or table, and thoroughly flooded with water, the print is laid on the plate and brought into contact with the plate by two or three strokes of a flat squeegee. Light but firm pressure should be used, the print must not be forced into too intimate a contact with the plate. The plates should be placed in a good current of air or in a well-ventilated warm room for the prints to dry, and if the work has been performed correctly, the prints can be easily removed when dry by inserting a knife under one corner and pulling the print from the

plate. If the plates are in very good condition the prints will frequently leave them spontaneously when dry.

Heat must on no account be used to accelerate drying in the early stages, as it involves a serious risk of the prints adhering firmly and permanently to the plate. But when the drying is well advanced, a moderate degree of warmth may be used with advantage.

To ensure the prints leaving the plate easily when dry, and to avoid any risk of their sticking, the formaline bath should be employed as directed during the washing after fixing; the prints should be dried after washing and re-wetted for squeegeeing, and it is imperative that there should be plenty of water between the print and the plate when the former is squeegeed into contact, and the squeegeeing must not be too heavy. At the moment of squeegeeing the print must be floating on water on the plate in such a way that the lightest touch will make it move in any direction. This condition is essential; if the print is already clinging to the plate before applying the squeegee it will inevitably stick.

Prints that have been hardened with formaline and dried on a ferrotype, may be mounted with only a slight loss of gloss. They should be immersed in water for four or five seconds—*not longer*—the superfluous moisture blotted off, the print placed face down on plain white paper and any good starch paste applied to the back, and then it may be pressed down on to the mount with blotting paper without any difficulty arising. Should a little fluff from the blotting paper adhere to the face of the

print it may be rubbed off by means of a soft handkerchief when the print is perfectly dry. This rubbing will always improve the appearance of a print as there is frequently an almost imperceptible fluff on the surface after mounting.

TEMPERATURE.

It is desirable to keep the temperature of all solutions as near sixty degrees as possible. If toning and fixing baths are colder than this, they work slowly and unsatisfactorily; if warmer there is a risk of softening the gelatine and spoiling the prints. In cold weather it is easy to raise the temperature of the solutions, but in warm weather it is sometimes very difficult to cool them sufficiently. When toning and fixing separately, or using self-toning paper, or employing platinum toning, when the preliminary washing and the extra time in the solutions tests the endurance of the gelatine film very severely, it is desirable to use an alum bath during the preliminary washing. When using the combined toning and fixing bath, the use of alum is not necessary as the prints remain in the solution for much less time. But it is desirable to employ the formaline bath as soon after fixing as possible, after five to seven minutes' washing only. These precautions are necessary in very warm weather only.

P.O.P. is not in any way a difficult process to work; it has advantages that commend it to many workers. If the methods given in this article are carefully followed success is certain.

BROMIDE PRINTING AND TONING.

By

C. WINTHORPE SOMERVILLE.

(The making of bromide prints by contact is a good preliminary to the making of bromide enlargements. Mr. Somerville has specialized in all the useful methods of toning bromide prints, and those interested in this work should consult his book on the subject, as it is too extensive to be fully dealt with here).

I. *CONTACT WORK.*

THE bromide process is unquestionably the simplest of all printing processes, in that it can be made the most mechanical.

But, while it can be made to produce by mechanical means with mechanical regularity the most perfect graphic reproduction in the positive from a given negative, it can also be made to exhibit the most subtle individuality desired by the art worker.

For general and commercial purposes it is pre-eminently the most useful from the points of view of economy and efficiency, fulfilling the most exacting demands in reproduction work.

In view of the fact that within the last few years it has become such a necessity to the commercial photographic printer I propose to discuss it to some extent from his aspect as well as that of the beginner and the art worker.

In bromide printing we have the most rapid of all

processes. Complete independence of daylight, greatest independence of the quality of the negative, and the greatest possibility of altering the gradation scale of an unsuitable negative for a particular subject.

It is the most comprehensive and adaptable of all processes.

It is not within the scope of this article to deal at any length with the scientific consideration of the process, but since complete and easy success depends upon the knowledge of a few fundamental chemical facts these must be grasped. They are very simple and very obvious.

The greatest and most important is the following:

Such an exposure may be given to bromide paper through a negative that the image may be developed to infinity without the possibility of over-development.

PRINCIPLES GOVERNING THE PRODUCTION OF A BROMIDE PRINT.

Bromide paper is simply paper of a particular quality and manufacture, coated with an emulsion of bromide of silver, and similar in almost every way to the emulsion on an ordinary plate, but some ten times less rapid.

The chemical manipulation necessary to produce an image, or graphic result, on bromide paper is precisely similar to that required for a negative except that the developers are modified in strength.

Bromide paper will stand a tremendous amount of chemical treatment without injury, but it must be remembered that the support of the emulsion is paper and not glass, and therefore careless handling is liable to produce stains and markings; but there need be no fear in this direction if ordinary care and a paper of standard reputation be used.

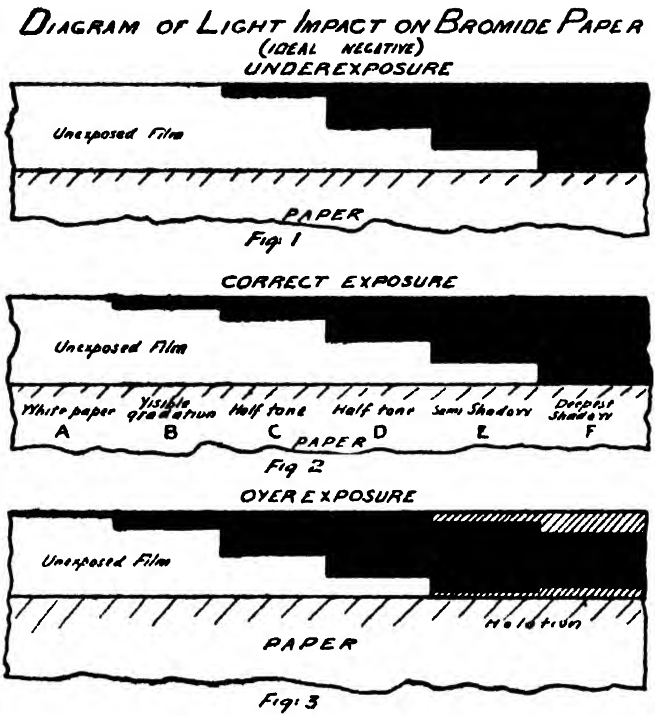
When light acts on bromide paper it creates an invisible change in the emulsion, or film, which renders the bromide of silver amenable to reduction to the metallic condition in a very fine state of division. (If examined under a powerful microscope the particles of silver would be seen fairly equidistant from each other; and I mention this fact because I shall have cause to refer to it later for special purposes).

The reduction to the metallic condition is effected by means of the developer, and wherever light has affected the film, some or the whole of the silver bromide salt will be developable to the metallic condition—the amount depending on the duration of the light impact—if sufficient time be given to the action of the developer.

But, however thin the film of emulsion may appear it must be borne in mind that it consists of top and bottom and intermediate layers of silver bromide particles, and if the light impact be of just sufficient duration to create a change in the bottom layer it will have created a greater effect on the top layer.

Now, if a light of a certain intensity acts too long on a bromide emulsion the change created is too great to allow of development to the pure black metallic condition and the result is to obtain a grey particle instead of a black one. This is known as reversal; it is due to over-exposure, and produces the well-known effects described as "muddiness" and "flatness."

The following diagram will enable the reader to understand more clearly the effects of under, correct and over-exposure.



For practical purposes it may be assumed that it is possible for the paper to receive just that amount of light necessary to render all the bromide of silver in a certain spot amenable to development to the black metallic condition. This is seen at F in figures 1 and 2.

In figure 3, E and F have received too much light so that not only has the top layer started reversal, as shown by the hatched portions, but the light striking back from the surface of the paper itself tends to create reversal in the bottom layers.

EXAMPLE OF WINTER PHOTOGRAPHY

It will, of course, be understood that the diagram is purely an imaginary conception for the sake of illustration, and does not in any way represent the actual chemical and physical conditions created.

Given then, a negative of such ideal construction that the exposure required to give just visible gradation on the paper through the highest light is exactly that necessary to develop the whole of the silver under the shadow part (bare glass) to the most perfect condition, that exposure would be known as 'correct,' shown in figure 2.

If less than such an exposure be given the result would be as figure 1, with, perhaps, not so much silver developed as shown at F.

It will readily be seen that under-exposure is irredeemable since there has been insufficient light impact at B to give visible gradation.

In brief, the simple chemistry is this.

When light acts on the paper it effects a change in the emulsion, which change is only rendered visible by development. The extent of the change has a two-way limit, technically known as under-exposure and over-exposure. The actinicity, or power of the light, or the period of its duration, acting on the paper after passing through the negative may have been insufficient to effect the necessary change in the emulsion in all and various parts, to yield a correspondingly correct reproduction in the positive on development. This is the under-exposure limit.

On the other hand, the exposure may have been too prolonged in all or some parts, in which case the change effected in the emulsion has passed the limit for complete development and commenced to

decompose it, or render it beyond control for the desired gradation. This is the limit of over-exposure.

THE NEGATIVE.

The negative is, of course, the governing factor in the quality of print obtained.

A thin, weak negative will only give a similar print, for the reason that since the bromide of silver in the emulsion requires a certain amount of light action to render it completely developable, this will have been more than sufficient to produce just visible gradation through the highest light with the exposure required for the complete development of the shadows.

A vigorous negative can be made to give almost any desired result by manipulation in exposure and development, but a weak one is difficult to treat satisfactorily.

THE DARK-ROOM LIGHT.

This is one of the most important factors in successful work. *You must see what you are doing.*

Bromide paper being about ten times less sensitive than an ordinary dry plate, it follows that a light ten times more luminous may be used.

The colour of the light also is of great importance, since the depth of tone of a positive varies considerably in appearance with different tints.

A yellow or canary tint is quite the best, and so long as the light is safe it is immaterial how much there is of it, except that the greater the area of illumination the better we can see our manipulation.

The law of light radiation is as follows. *The intensity of a light is inversely proportional as the square of the distance from its source.*

That is to say, if the value of a light at one foot from its source is equal to 100, then at two feet it will be equal to 25, at three feet 11·1, and so on. It follows, then, that if our light has no effect on a piece of bromide paper at one foot from the face of the lamp after a period of five minutes, at two feet it may be exposed without danger for twenty minutes.

The safety of the lamp is largely dependent on the form of light used. Allowing a distance of six inches between the burner and fabric or screen an oil lamp would only require one thickness of canary fabric; a flat flame gas burner one thickness of fabric and two thicknesses of tissue paper; an incandescent mantle two thicknesses of fabric. Yellow glass may be used if preferred, if covered with some diffusing medium. The eyes should always be shielded from the light.

THE PRINTING LIGHT.

Here we have our first form of control over a negative.

Artificial light only should be used, and the following general rules may be applied as required.

A very vigorous negative (harsh contrasts), print close to a white light, such as incandescent gas, acetylene, electric arc, or magnesium ribbon, but never at a less distance than two feet. Pale blue glass may be interposed to increase the actinicity. A normal negative-print, five feet from flat flame or oil lamp, or a diffused incandescent gas or acetylene. A thin, weak negative, print as far away from a yellow form of light as possible, but if only white light is available interpose, if possible, a piece of

pale yellow glass or pyro-stained unexposed fixed plate.

Print by diffused light for preference, and use some form of graduated board scaled to the light intensity law so that exposures can be exactly repeated at any time.

DEVELOPERS.

Speaking generally, there are three classes of developers: Those which build up the density of the shadows very rapidly and produce the high-light detail only towards the end of development; those which produce density and detail at approximately the same rate; those which allow of the development of high-light detail before the shadow density has accumulated to any extent. The last class are the best for bromide work where control has to be exerted, and Rodinal is one of the finest reagents for the work. On the other hand, a judicious combination of the first and last produces quite as good results and is more rapid in action where time is a consideration; thus I know of no finer combination than hydroquinone, which belongs to the first series, and metol, which belongs to the last series.

There is, however, one developer of the second series which undoubtedly gives the finest tone of developed silver on bromide prints, especially if subsequent toning is intended; I refer to amidol. Unfortunately amidol cannot be used for very prolonged development as, whatever precautions be taken, it has a tendency to stain. But for contact work it is quite suitable, as extended development is rarely carried out.

Manufacturers give their own formulæ and they should know what suits their papers, but I give formulæ for all three series which have been exhaustively tested in almost every direction.

METOL-HYDROQUINONE.

Metol	100 grains	or	10 grammes
Sodium sulphite	3 ounces		150 ,,
Potassium carbonate	1½ ,,		75
Water	40 ,,		1000 c.c.
Hydroquinone..	50 grains		5 grammes
Water	40 ounces		1000 c c.

Dissolve and make up in the order given. Note the absence of bromide of potassium. This should never be included in a developer but added as required from 10 per cent. solution at the time of development.

AMIDOL.

Amidol or Diamidophenol ..	50 grains	or	1 gramme
Sodium sulphite (crystals) ..	650 ,,		13 grammes
Water	20 ozs.		200 c c

Dissolve and make up in order given and use potassium bromide as required.

RODINAL.

Rodinal	30 minims	or	10 c.c.
Water	1 ounce	,,	160 c c.

Bromide to be used as required.

With this developer there is an apparent loss of density on fixing, so that development should be carried a little farther than with either of the other formulæ if the same density or intensity of gradation scale is required.

DURABILITY AND PERMANENCE OF BROMIDE PAPER.

To this day some professional photographers are under the impression that bromide paper is not permanent. The idea is evidently a relic of the

days when an iron developer was used and hydrochloric acid the reagent for clearing the iron from the paper, any chloride salt left in acting as a bleaching agent.

Although silver is not such an inert element to atmospheric influence as carbon or platinum, in the form of a developed and fixed print it is as permanent as either, since the support would disintegrate long before the metal could ever possibly be affected.

In the year 1889 I made my first bromide print on Barnet paper, rough ordinary grade, which at that time, I believe, was their only variety. This print, after standing the vicissitudes of many and various dark rooms, changes of residence, etc., I have by me now in as good condition as when first made.

A sulphided print is absolutely inert to any atmospheric condition whatever.

PRINTING.

When taking the paper out of the packet the sensitive side may be determined by inserting one corner between the front teeth and pressing hard for a second or two, when the sensitive side will stick slightly.

The negative is placed glass side outward in the printing frame and the sensitive side of the paper placed against the film side of the negative.

DEVELOPMENT.

The action of light on an emulsion may effect a change to such an extent that the silver is developable to a limited or fixed extent.

The rapidity of development is governed by the

strength of the developer, but over-exposure develops more rapidly than under-exposure.

If your print is over-exposed through the densest part of the negative you cannot carry development to infinity, *i.e.*, as far as it is possible to develop, therefore you must control by the application of bromide in order to keep down over-gradation of your highest light.

Bromide of potassium has the effect of preventing the least exposed parts of the print from developing as rapidly as the more exposed, and so shortening the scale of gradation and increasing the contrasts. The tone of the print is, however, bound to suffer more or less, in that some parts of the silver will not be completely developed and, therefore, will be of less intensity. Such a condition may be desired for purposes of special effects, but if not it can generally be remedied by intensification.

If development were carried to infinity the bromide would lose its control and the resulting print be as though it had never been added.

Providing there be sufficient of the developing agent present a weak (dilute) developer will produce precisely the same effect as a strong one, time being the only consideration.

It is possible to use such a weak developer—say, normal fifty times diluted—that the image may be entirely brought out, all detail being visible, in a ghost-like state; and from this gradually to build up the shadows and density as required by strengthening the developer and adding bromide. When such a dilute developer is employed for that purpose there should be no more than a trace of bromide present to keep the emulsion free from fog.

THE IDEAL NEGATIVE.

This is a negative of such condition that at a certain distance from a certain quality of light the exposure necessary to produce just visible gradation through the highest light is exactly that required for complete development of the shadows upon development to infinity. We may never get one, but we shall often get near it, and by manipulating printing distance and controlling development obtain practically as good a result.

If it is possible to develop to infinity the most perfect rendering of the gradation of the negative in the positive will be obtained; but I do not say that it is always the best thing to do, far from it; the subject has to be considered before all things.

The exposure required for the above description of an ideal negative is that technically known as "correct," and any departure from it would be known as under-exposure or over-exposure. Over-exposure is indicated by the almost simultaneous appearance of the higher light gradations with that of the shadows. Under-exposure is indicated by the almost complete development of the shadows before the high-lights appear. Correct exposure is indicated by the initial appearance of the shadows, then the half-tones and finally the highest light by the time the shadows are sufficiently dense.

Always judge whether a print is sufficiently developed by looking *through* it toward the dark-room light; the intensity of the shadow tones is more accurately estimated by so doing, and its appearance is almost precisely that of the fixed print.

Under no circumstances whatever should a print have to be *snatched* out of the developer because it shows signs of going too far. Get your exposure right by making a trial with a small piece of paper placed over the highest light you require to be visible in the finished print and develop to infinity with a normal developer containing a trace of bromide; then give about 10 per cent. in excess of this for the actual print. By so doing you will always be able to reach the highest light gradation point and have a little margin in cases where development to infinity cannot be secured.

The addition of bromide at any stage before development to infinity will check the high-lights, but the nearer the limit of development the less will be the effect.

Although bromide prevents the complete development of some parts of the gradation scale these parts will always be nearer to the highest light than the shadows, thus the shadows may be completely developed where they would otherwise be weak owing to partial reversal due to over-exposure. Commercial printers should remember this fact because incompletely developed shadows are fatal to sulphide toning in the matter of depth of tone, while an incompletely developed high-light is not so serious since the tone is so much higher up the colour scale, and therefore not so noticeably weak.

FIXATION.

The undeveloped bromide of silver left in the print has to be removed, otherwise it would be reduced by the action of light, and degradation of print would occur.

The formula in general use is :—

Hyposulphite of soda	1 ounce	or	10 grammes.
Water	10 ounces	,,	100 c.cs.

It is difficult to say how many prints one ounce of hypo will fix, and there is no indication when the bath is exhausted. It is therefore wise to be generous in the quantity of solution used, and to avoid all possibility of over-working a bath.

A long-used plain hypo bath will gradually discolour by reason of the developer transferred to it from the prints, and to prevent this it is acidified,

An acidified fixing bath is a dangerous thing if not suitably constructed.

I give a formula.

Hypo	1 oz.	or	10 grammes.
Potassium meta-bisulphite ..	50 grains		1 gramme.
Water	10 ozs.		100 c.c.

Prints may be transferred straight to the fixing bath without preliminary washing, but care must be exercised to see that they are immediately covered by the solution, otherwise stains may occur. They should be fixed for not less than ten minutes.

If you can possibly do so avoid alum in the fixing bath. It is a more general cause of sulphurization, degradation and blisters in prints than photographers are aware of, especially among professionals.

After fixing, prints should be washed for one hour, post-cards rather longer.

DEVELOPING LARGE NUMBERS OF PRINTS.

Use a considerable volume of developer in a dish rather larger than the size of the print.

Push the exposed print face up *under* the solution. When developed pass once through water then into fixer. Where development has to be arrested before infinity the acid fixing bath instantly prevents further action of the developer if an alkaline solution is used.

PREVENTION OF EXAGGERATED DENSITY.

A negative of, say, a landscape may be of such quality that it is impossible to get a good reproduction of the sky, because the foreground develops to too great a density. Or similarly in a portrait study the drapery becomes too dense by the time the lightest tones required are visible. Valuable assistance in overcoming the difficulty may be obtained by the following process.

The exposure should be made as usual for the highest light required with an increase of about 20 per cent.

The print before development is then treated for one minute in the following solution :—

Copper sulphate (pure) ..	5 grains	or	1 gramme.
Potassium persulphate ..	10 ,,		2 ,,
Nitric acid	10 minims		2 c.c.
Water	20 ounces		2000 c c.

Wash briefly in two changes of water and develop as usual.

DRYING PRINTS.

Prints may, if specially required in a hurry, be rapidly dried by treating with *two* changes of alcohol or methylated spirit. Otherwise, after washing lay them on a clean towel laid flat on an inclined surface.

When dry they are much improved by rubbing with a plug of cotton wool soaked in alcohol.

INTENSIFICATION.

Prints from a weak negative should be developed as far as it is possible to do so without seriously overdoing the highest light, so that there may be sufficient developed silver to make intensification successful.

Experience has convinced me that there is only one satisfactory method of intensification for bromide prints, and that is by redevelopment without the addition of other metallic salts.

By this means the silver particles are simply rearranged in such a manner as to form a denser accumulation, development fog is eradicated, and the gradation in the highest lights reduced.

Bleach the print as for sulphide toning, and instead of applying the toning reagent redevelop with a normal developer till no further gradation is obtainable. The process is virtually a shortening of the gradation scale.

II. TONING.

The possibility of producing prints in colour by simply chemical operation is undoubtedly one of the most fascinating features of the bromide process.

Time was when the tones obtained were uncertain and fugitive, but it required only some concentration on the problem to remedy this. Now we can depend on obtaining permanent results in black, brown, sepia, red, crimson, blue, green, violet, purple, etc., and intermediate shades of these.

Silver, fortunately, is an element which lends

itself to the replacement by, and deposition of, other metals and their salts very easily; and it is by employing the particular salts possessing the various colours, or allowing the coloured salts to be formed from them, that the toning of the print is effected.

The majority of toning processes are effected through the medium of the halogen elements, with the exception of the ferrocyanide, and a ferrocyanide is so closely allied in its actions to a halogen that in photographic chemistry it has, for technical purposes, been regarded in that light.

The halogens are Chlorine, Bromine, Iodine, Fluorine, and Ferrocyanogen, and metallic silver is easily converted into the corresponding chloride, bromide, iodide, fluoride and ferrocyanide.

Now for an illustration of the chemical reactions which occur in toning a print. Take the so-called sepia tones formed by sulphiding.

Your black metallic silver print is treated with a bromizing reagent to convert it to bromide of silver. Bromine vapour in the presence of moisture would do this but it is not a convenient reagent to use; there are other methods, and in 1902 I introduced into this country the now universal bromo-ferrocyanide reagent.

This is a combination of the bromides and ferrocyanides of an alkali such as potassium, and when the print is subjected to it you have to conceive the primary formation of ferrocyanide of silver, but since a ferrocyanide of silver could not exist in the presence of the stronger halogen, bromine, it is instantly converted into bromide of silver.

While pure silver is but slightly affected by

sulphuretted hydrogen, the haloids of silver are extremely sensitive to it. The least trace of sulphuretted hydrogen whether free or combined with an alkali in a solution is absorbed by the haloid of silver to form a third salt, silver sulphide.

Now, silver sulphide is in reality black, but owing to the fine state of division in which it is formed in the print it appears brown or sepia, and the more complete the development of the silver, or the denser its aggregation in the film, the deeper, colder, or nearer to the black the sulphide salt will be.

Hence, from the exposure made to the plate in the camera, through the development of the negative, through the exposure and development of the print, the depth of the tone in a sulphide print depends.

It is well to remember that it is an absolute law that the exposure in the camera fixes the depth of tone it is possible to get in the final print.

Silver sulphide is, of all chemical salts, one of the most permanent, and could never be affected by any atmospheric condition.

In the following series of processes I do not propose to give a variety of methods for obtaining the same colour, but rather the simplest and most efficient in the hands of the average worker and, as far as possible, available for commercial purposes.

One remark I must make here, although perhaps not strictly within my province, as the subject is ably dealt with elsewhere. But it has been my experience that beginners often confuse "gaslight" papers with "bromide," and as the majority of gaslight papers do not give such good depth of

tones as bromide, especially in sepia, disappointment is the result.

TONING PROCESSES AND THEIR MANIPULATION.

The intensity or depth of tone is entirely dependent on the quantity and density of the silver developed in the print, and the following may be regarded as laws governing the depth of tone to be obtained.

1. Slight under-exposure developed to infinity will produce the greatest depth of tone.
2. Over-exposure and under-development will give the weakest tone.

Too much stress cannot be laid on the necessity for the complete absence of hypo. The minutest traces of it are fatal to toning.

THE SULPHIDE PROCESS.

This is undoubtedly the most popular of all bromide toning processes.

It seems hardly possible to fail in always obtaining perfectly satisfactory results except from an unsuitably developed print. Yet failures do occur and not always with the careless; I therefore propose to discuss one or two possible causes.

By the formula given below the silver is bleached into bromide of silver and finally converted into sulphide of silver by the application of free sulphuretted hydrogen.

Bleach the print as far as possible in

Potassium ferricyanide ..	10 grains	or	1 gramme.
Potassium bromide ..	10 ,,		1 ,,
5 per cent. ammonia ..	20 minims		1 c c.
Water	1 ounce		50 c.c.

Wash till print is quite free from yellow solution and tone in a *freshly made* solution of

Sodium sulphide (about) ..	10 grains	or	1 gramme.
Water	1 ounce	,,	50 c.c.

Allow to remain at least one minute after toning appears to be complete.

Wash ten or fifteen minutes according to thickness of paper.

Failures are possibly due to :—

1. Hypo present in the print before bleaching, in which case as the silver is being converted to the bromide salt the hypo dissolves it.

2. Hypo in the sodium sulphide.

Sodium sulphide, however chemically pure, is attacked on exposure to air and partly converted into sodium thiosulphate (hypo) and sodium hydrate.

Remedy. Get to judge the size of a ten grain crystal and take from the bottle one [illegible] larger; wash it by swishing it round in the measure for half a minute with water; throw away this solution and add the crystal to an ounce of clean water.

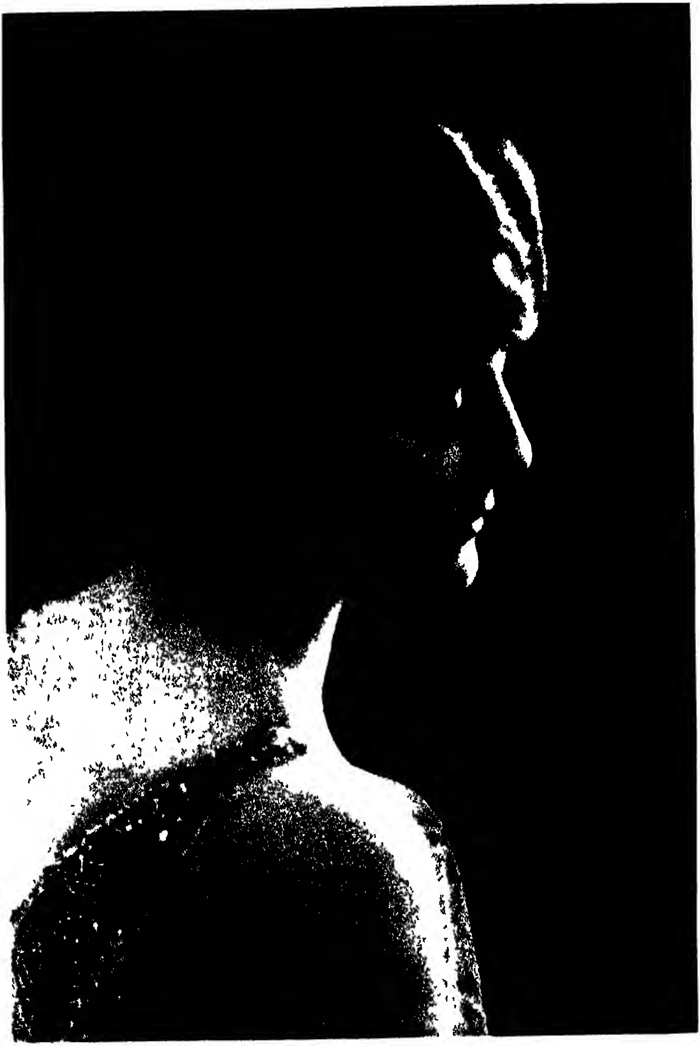
Do not use the same solution for more than an hour, and do not bottle it up for further use.

3 Iron in the sodium sulphide

If present in large quantities as in the commercial salt this is liable to produce a brown or yellowish staining of the whites.

The remedy is not easy, and hardly within the scope of the average worker's experiments.

Repeated boiling down and recrystallization of the salt has been recommended, but even this will not entirely get rid of traces of the iron. The process is rather a complex one and only to be



EXAMPLE OF STUDIO WORK

(Claude Harris)

successfully dealt with by chemical manufacturers who have the necessary plant and skilled workmen.

Impurities in all sulphiding solutions play such an important part in failures that it is more profitable to use a ready-made preparation guaranteed in these directions.

As stated, a weak negative will give a weak print and therefore a weak tone; but having done the best with the negative something may be done with the print by intensification to give greater depth of tone in the shadows.

Commercial printers should see that their bleaching solution is always slightly alkaline, as this facilitates washing previous to toning, and prevents blisters to a very large extent. One ounce of washing soda per 5 gallons of solution should be sufficient.

HYPO ALUM PROCESS.

This process for producing sepia tones by sul phiding is used principally by commercial printer for, I believe, the only reason that it gives good tones with prints of indifferent intensity.

No bleaching of prints is required, the tone being effected direct by a rather complex reaction from a colloidal solution of sulphur.

It is, however, very tedious and very unpleasant to manipulate where only an occasional amount of work is done.

The following is one of the best formulæ :—

Hot water	1 pint or	1000 c.c.
Hypo	2½ ozs. ,,	125 grammes

Dissolve and add

Alum	⅞ oz. or	25 grammes
Sugar	⅞ oz.	25 ,,

The bath should not be filtered and works better as it gets older. It may be strengthened from time to time with a little fresh solution.

Take the fixed and washed prints and place them in—

Alum	1 oz. or	50 grammes
Water	20 ozs. „	1000 c.c.

for ten minutes, rinse in a few changes of water and immerse in the above bath, which has previously been heated to 120 deg. F. (as hot as the hand can bear) and keep them moving the whole time.

They will take about 40 minutes to tone. When toned place them in a tepid alum bath of the following strength for about ten minutes, then wash and dry :—

Alum	1 oz or	50 grammes
Water	1½ pints „	1500 c.c.

The hypo alum bath when new tends to reduce the prints a good deal, and this must be allowed for when developing. The bath is greatly improved by soaking a few pieces of P.O.P. in it before use.

The tones are rather colder as a rule than those obtained by the sulphide process, but there is generally an alteration in the scale of gradation which tends to increase contrasts, and it is not under control.

There are many other colours to be produced on bromide papers, and the photographer who has already succeeded with blacks or browns would find it an interesting study to experiment with them. But the subject is too wide to be adequately dealt with here.

BROMIDE ENLARGEMENTS

F. J. MORTIMER, F.R.P.S.

(Skill in producing first-rate bromide enlargements is a tremendous asset to the photographer. The work of Mr. F. J. Mortimer in this direction is of world-wide reputation, and his advice is therefore of exceptional value).

IT may be assumed that the desire for making a large print from a comparatively small negative arose in the earliest periods of photography, but there is no doubt that enlarging, as we understand it to-day, was not generally practised until the invention of gelatino-bromide paper made it both simple and certain.

As the subject of bromide paper and contact printing is dealt with elsewhere in this book, it will not be discussed further here, but only its application to the making of enlargements by means of enlarging apparatus.

Nowadays, when the hand camera is so extensively used and negatives of small sizes such as quarter-plate, $2\frac{1}{2} \times 3\frac{1}{2}$, and smaller, are produced in great quantities by amateurs—mostly snap-shot holiday records—it behoves every photographer to have at hand a ready means of making bigger prints from these negatives than would be yielded by contact printing.

The worker is thus enabled to produce pictures in the real sense of the word, as it is quite possible in

many cases to utilise even small portions of the little negative for the production of exhibition pictures that would not have been obtainable otherwise. It is a fact that numbers of negatives are discarded by amateurs, not because they are technically bad or unsatisfactory as records, but because their pictorial attributes are not as perfect as they might be when contact printing alone is relied upon. By making enlargements from portions of such negatives, however, it is possible to produce results that will give every satisfaction.

It is not too much to say that in ordinary circumstances an enlarged photograph of any given subject is always more attractive than the original small print; this in spite of the axiom among pictorial workers that a good composition will look well in any size. The fact remains that unless the composition and its treatment are of exceptional merit the points of interest in a tiny print are apt to be overlooked, whereas in an enlarged edition of the same subject emphasis can be brought to bear on any desired feature.

THE NEGATIVE.

It is well at this point to consider a factor that has an important bearing on the quality of a direct bromide enlargement—namely, the sort of negative that is best suited for the purpose. The negative that looks plucky and brilliant, and might yield a good bright contact print, is not always the ideal negative for enlarging. What is required in the small negative, apart from sharpness of focus (which is a *sine qua non*) is a wealth of detail and delicate gradation. There should be no hard

contrasts, and undue density is to be avoided. Such negatives, fortunately, are easy to obtain with the modern small camera owing to the fact that the short-focus lenses, frequently of large aperture, which are fitted, produce well exposed negatives that, in addition to possessing fine detail, can be regarded as "soft" when properly developed. If the negative has too much contrast it will be found that there is always a tendency to increase contrast in making an enlargement on bromide paper, especially with artificial light.

ENLARGING APPARATUS.

For the production of bromide enlargements from a negative, enlarging apparatus of some kind is necessary. This may be divided, for convenience' sake, into two classes—first, that required for daylight enlarging, and secondly, that required for artificial light.

Enlarging by daylight will be found a very convenient and cheap method, but unfortunately the changeable quality of daylight in this country introduces an uncertain factor that is likely to be a source of trouble to many workers. Nevertheless, the quality of prints obtained when daylight is the illuminant is generally very good, and the light, when it is bright, is usually the best that can be advocated for dense negatives. Two methods of working may be employed, one using the actual light of the sky itself, and the other using reflected sky light.

Special daylight enlargers may be used. These in construction are practically two cameras, a large one and a small one, end to end, with one lens

between them. The negative is placed in the dark slide or carrier of the small camera, and the bromide paper in the dark slide or carrier of the big one. In fixed-focus enlargers of this type nothing further is required than to make the exposure by pointing the small end of the complete enlarger towards the sky and uncovering the lens for the requisite time. If it is a focussing enlarger, the image projected on the focussing screen at the larger end of the double camera is focussed by rack and pinion. It is then clamped into position, the carrier with the paper inserted, and the exposure made in the same way as with the fixed-focus enlarger.

USING THE CAMERA AS A DAYLIGHT ENLARGER.

For the average amateur who desires to use a darkened room and his own camera for the purpose of making enlargements by daylight, the best plan is to make (or get a carpenter to make) a light framework of 2-inch battens to fit the entire window and to button home into place. This framework is strengthened by cross stays. It is then covered with a piece of unbleached calico which can be stretched tightly across from side to side and end to end, and tacked into position. On this is pasted brown paper, so as to make an entirely opaque shutter or screen for the window. American cloth or other opaque material can, of course, be used, but calico and brown paper are cheapest and can be easily repaired, if damaged, by pasting on more brown paper. If preferred, the covering can be two or three thicknesses of "ruby fabric." The

light filtered through this will serve as an illumination for the darkened room.

Arrangements should be made, when fixing the cross stays to the frame and arranging the covering, to leave near the centre and at a convenient height a small square opening a little larger than the size of the back of the camera. A cross piece of wood should come just at the bottom of this opening in the shutter, so that a small shelf the size of the baseboard of the camera can be screwed on. To use this contrivance for enlarging, the shutter is fixed in position in the window, the camera is placed on the little shelf in front of the hole in the shutter; (it should be made so that the camera can be screwed on to the shelf with the tripod screw). The camera is so situated that its back nearly fills the hole, and the lens is pointing into the darkened room.

An easel or drawing-board is now arranged in front of the camera, and the negative from which the enlargement is to be made is placed in a dark slide or carrier in the back of the camera. (If a double dark slide is used, both shutters must be withdrawn so that the light can pass through). A focussing cloth or other opaque material is pinned round the back of the camera to exclude any extraneous light, and the image of the negative is projected "magic-lantern" fashion on to the easel in front. If the window outlook is a clear stretch of sky, the lighting arrangements will be good enough, but as this is unlikely, it is usual to arrange a large piece of white card, or even a special corrugated glass mirror, at an angle of 45° outside the opening in the window screen, to reflect the sky light through the negative. The easel should be

arranged so that its front, on to which the picture is projected, is perfectly vertical and parallel to the camera back and negative; otherwise the picture will be distorted. If a drawing-board is used, it can be supported in a vertical position on a table drawn up to the window. Focussing the image is accomplished with the ordinary rack and pinion of the camera. The correct distances of negative from lens and lens from paper are given later. Fine focussing, however, must be done with the rack and pinion, and visual inspection of enlarged image.

ENLARGING BY ARTIFICIAL LIGHT.

Artificial light enlarging is likely to prove the best for most amateurs, especially those engaged in business during the hours of daylight.

The artificial light enlarging lantern is usually made of sheet metal or wood lined with tin or sheet iron. This is the body of the apparatus. A metal top and cowl, side and back doors, condenser, extending metal collars to allow alteration of distances between lantern body and condenser, carrier stage to which the condenser is fixed, and arranged to take carrier with negative, extending front, usually leather or cloth bellows, wooden front with lens panel, the whole mounted on baseboard, movable, with sliding and rack and pinion movements so that each part can be altered in relation to the other.

THE LENS.

The projection lens should be of large aperture to permit the greatest amount of light to pass and so shorten exposures. A lens of the anastigmat

variety is best, as it possesses a flat field. There are now many extremely rapid lenses which have a flat field, and so may be used for enlarging at the open aperture. With such an anastigmat, working at an aperture of $f/4{\cdot}5$ or $f/5{\cdot}6$, enlarging exposures may be quite short, even if the light used is not very powerful. On the other hand, the use of a powerful light enables a cheaper R.R. lens to be used, or this may be stopped down and good definition thus secured all over the picture.

A yellow glass cap should be fitted to the lens. This allows an image to be projected which will yet not fog the bromide paper, unless, of course, the paper is exposed to it for a considerable length of time. Focussing should never be attempted with the yellow cap on the lens. Its chief function is to allow the bromide paper to be put into the correct position after focussing on a sheet of white paper.

For the easel on which to pin the bromide paper a soft yellow pine drawing-board, on which one may pin a sheet of white blotting paper to focus upon is to be recommended. This can be fixed to a piece of stout wood, so that it will stand in a vertical position on the enlarging bench. Special enlarging easels are now readily obtained from all dealers, and are much better than any makeshifts.

THE CONDENSER.

The function of the condenser is to collect the rays of light and project them through the negative. The usual form of condenser employed is two plano-convex lenses placed with the two convex surfaces nearly touching each other. The first

question to decide when purchasing an enlarging lantern is, what size condensers are required, as the size of the condensers governs the price. It is a query which has often been raised by beginners as to which size condenser will cover a certain sized plate. This is by no means difficult to decide. All that it is necessary to do is to measure the diagonal of the negative in question, and this diagonal will be the diameter of the required condenser.

THE ILLUMINANT.

The illuminant for the enlarger may be one of many forms. Mineral oil lamps are not now generally used, but gaslight is very popular, used with a mantle for an incandescent light. The oxy-hydrogen limelight is also used occasionally, and the Nernst electric light, the electric arc, and acetylene are also available. Amongst amateurs, too, the spirit-vapour lamps are popular, and afford a self-contained light of intense power which is cheap and efficient.

Whatever form of light is chosen, however, it is well to become conversant with its use before attempting to make enlargements. Otherwise, one may not utilise the greatest available power it affords.

It is important that the light should be properly centred, as otherwise dark non-actinic spaces will be seen on the enlarging easel, which will appear as white patches in the enlargement.

To centre the light, *i.e.*, to get the disc of light projected by the lantern even and clear, it is necessary to move it about inside the lantern until the

best effect is obtained on the screen. Having lighted up, take off the cap of the lens and examine the disc of light on the easel. It may be brighter at the top than at the bottom. That is because the light is too low. Raise the light, and you will find the patch of white move downwards. What you want to aim at is to get the patch of light just in the centre of the disc of illumination. When you have secured this, you may be sure that the light is properly centred. If a patch of shadow appears at the top of the side, move the light down. If on one side, move the light in the opposite direction.

The lens is fixed to the front panel of the lantern in a position opposite the centre of the condenser, so that normally the condenser and the projection lens are centred on the optical axis. The lantern front may have a rising front or not. It is a movement which is scarcely necessary, as one can always place the bromide paper in just the desired position on the easel. If there is a sheet of ground glass between the light and the condenser it is permissible to make small adjustments by raising the front, but if without the ground glass it is practically essential to keep the lens opposite the centre of the condenser.

ADJUSTING THE DISTANCES FOR ENLARGING.

To get the light at the proper distance from the condenser, remember this varies with the *degree of enlargement*. For instance, one may enlarge from 5×4 to 15×12, which is an enlargement of three diameters, 15 being three times 5. Or one may

enlarge from a part of a negative masked down to $2 \times 1\frac{1}{2}$, and the enlargement may measure $6 \times 4\frac{1}{2}$. This, again, is exactly three diameters, the enlargement being three times as long as the required portion of the original negative. In both these cases the positions of light and condenser would remain the same, as indeed would the positions of the projection lens and easel. But suppose one wants to make an enlargement 15×12 from the $2 \times 1\frac{1}{2}$ bit of the negative. The *actual* size of enlargement, *viz.*, 15×12, is the same as in the first case, but it will be found that all the distances require altering, including the distance from light to condenser.

It may be taken as an accepted axiom that the nearer the light is to the condenser and the nearer the condenser to the negative, the greater will be the illumination; and the greater the distance between the lens and sensitive surface the less the illumination. Or, in other words, the larger one enlarges the longer one must expose, everything else being constant.

There is one precaution necessary when using condensers, or artificial light of any kind with condensers, and that is to see that everything is gradually warmed. Do not turn the light full on at once, and place it close up to the condenser, or it will not be surprising if the condenser cracks. Warm everything gradually by having the light low and some distance from the condenser, and reduce the distance and increase the light by degrees.

It will be obvious to the merest beginner in enlarging that the farther the lens is from the sensitive paper the larger the image, and *vice versa*;

and also that there are certain distances which bear a certain relation one to the other; so that when enlarging, the distances between the negative and lens and lens and sensitive surface bear a strict relation to one another. The approximate distances between the negative and lens and lens and paper, or conjugate foci, may be found from the following formula :—

$$(1)\ d = f + \frac{f}{n}$$

$$(2)\ D = (n+1)\ f.$$

Wherein d = the distance between the negative and lens.

D = the distance between the lens and sensitive surface.

f = the equivalent focus of the lens.

n = the number of times of enlargement.

Or to the non-mathematical mind we will put it in another way. To find the distance between the lens and sensitive surface, add one to the number of times (linear measurement) the negative is to be enlarged, and multiply by the focus of the lens. To find the distance between the lens and negative, divide the product of the above calculations, or the distance between the lens and sensitive surface, by the number of times of enlargement,' and the quotient will be the distance between negative and lens. For example, it is required to enlarge a quarter-plate negative to 16×12 with a 6-inch lens. $4\frac{1}{4} \times 3\frac{1}{4}$ enlarged to $16 \times 12 = 4$ times (linear). The distance will be then approximately $(4+1) \times 6 = 30$ inches, between lens and sensitive surface. To find the distance between lens and negative, $30 \div 4 = 7\frac{1}{2}$.

Focus of Lens in Inches.	Reduction.	1.	2.	3.	4.	5.	6.	7.	8.	Enlargement.
		Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
2	A	4	6	8	10	12	14	16	18	B
	B	4	3	2 2/3	2 1/2	2 2/5	2 1/3	2 2/7	2 1/4	A
2 1/2	A	5	7	10	12 1/2	15	17 1/2	20	22 1/2	B
	B	5	3 1/2	3 1/3	3 1/8	3	2 11/12	2 6/7	2 13/16	A
3	A	6	9	12	15	18	21	24	27	B
	B	6	4 1/2	4	3 3/4	3 3/5	3 1/2	3 3/7	3 3/8	A
3 1/2	A	7	10	14	17 1/2	21	24 1/2	28	31 1/2	B
	B	7	5	4 2/3	4 3/8	4 1/5	4 1/12	4	3 15/16	A
4	A	8	12	16	20	24	28	32	36	B
	B	8	6	5 1/3	5	4 4/5	4 2/3	4 4/7	4 1/2	A
4 1/2	A	9	13 1/2	18	22 1/2	27	31 1/2	36	40 1/2	B
	B	9	6 3/4	6	5 5/8	5 2/5	5 1/4	5 1/7	5 1/16	A
5	A	10	15	20	25	30	35	40	45	B
	B	10	7 1/2	6 2/3	6 1/4	6	5 5/6	5 5/7	5 5/8	A
5 1/2	A	11	16 1/2	22	27 1/2	33	38 1/2	44	49 1/2	B
	B	11	8 1/4	7 1/3	6 7/8	6 3/5	6 5/12	6 2/7	6 3/16	A
6	A	12	18	24	30	36	42	48	54	B
	B	12	9	8	7 1/2	7 1/5	7	6 6/7	6 3/4	A
6 1/2	A	13	19 1/2	26	32 1/2	39	45 1/2	52	58 1/2	B
	B	13	9 3/4	8 2/3	8 1/8	7 4/5	7 7/12	7 3/7	7 5/16	A
7	A	14	21	28	35	42	49	56	63	B
	B	14	10 1/2	9 1/3	8 3/4	8 2/5	8 1/6	8	7 7/8	A
7 1/2	A	15	22 1/2	30	37 1/2	45	52 1/2	60	67 1/2	B
	B	15	11 1/4	10	9 3/8	9	8 3/4	8 4/7	8 7/16	A
8	A	16	24	32	40	48	56	64	72	B
	B	16	12	10 2/3	10	9 3/5	9 1/3	9 1/7	9	A
8 1/2	A	17	25 1/2	34	42 1/2	51	59 1/2	68	76 1/2	B
	B	17	12 3/4	11 1/3	10 5/8	10 1/5	9 7/12	9 5/7	9 9/16	A
9	A	18	27	36	45	54	63	72	81	B
	B	18	13 1/2	12	11 1/4	10 7/8	10 1/2	10 2/7	10 1/8	A
9 1/2	A	19	28 1/2	38	47 1/2	57	66 1/2	76	85 1/2	B
	B	19	14 1/4	12 2/3	11 7/8	11 2/5	11 1/12	10 6/7	10 11/16	A
10	A	20	30	40	50	60	70	80	90	B
	B	20	15	13 1/3	12 1/2	12	11 2/3	11 3/7	11 1/4	A
10 1/2	A	21	31 1/2	42	52	63	73 1/2	84	94 1/2	B
	B	21	15 3/4	14	13	12 3/5	12 1/4	12	11 13/16	A
11	A	22	33	44	55	66	77	88	99	B
	B	22	16 1/2	14 2/3	13 3/4	13 1/5	12 5/6	12 4/7	12 3/8	A
11 1/2	A	23	34 1/2	46	57 1/2	69	80 1/2	92	103 1/2	B
	B	23	17 1/4	15 1/3	14 3/8	13 4/5	13 5/12	13 1/7	12 15/16	A
12	A	24	36	48	60	72	84	96	108	B
	B	24	18	16	15	14 2/5	14	13 5/7	13 1/2	A

To save trouble, however, there are well-known tables which have been calculated for enlargements with lenses of varying foci, and the table of enlargement or reduction given herewith (from the Dictionary of Photography) is based on the principles already explained, and is convenient for ready reference. The distances given in the table will be found to be approximately correct, but in all cases accurate focussing should be secured by adjustment of the screen or lens by rack and pinion. Whilst many operators are content to use merely a sheet of white paper and to focus from the front, it will also be found possible to use a ground-glass screen in easel and focus through the back. In all cases where marginal definition is defective, stops or diaphragm must be used exactly as in field work.

After getting the size of enlargement correct and the image sharp, remove the carrier holding the negative from the lantern, and examine the disc of light again. If it looks evenly bright all over, well and good. If, on the other hand, it is bright in the centre, the light is too far away from the condenser and must be pushed slowly forward until an evenly lighted disc is obtained. If the centre of the disc is dark the light is too near the condenser and must be drawn backwards. When the disc is evenly illuminated the negative may be returned to its position. This should be done without the ground glass between the light and the condenser, because it is so much easier to see the effect of a light too near the condenser or too far away from it. The inequalities of illumination are much less if the ground glass is there; but even when using ground-glass it is an advantage to adjust the position of the

light in the way just shown. With a light of great power, such as a large arc lamp, it is possible to use two sheets of ground-glass and to keep the lamp at a fixed distance from the condenser.

Having obtained a sharp focus, the next operation is placing the sensitive paper in position. The yellow glass cap is now used, and the paper is affixed to the easel in the required position by means of dark-room pins. In some enlarging easels the paper is sandwiched between a sheet of plate glass (which is held in position with suitable clips) and the easel board.

THE EASEL.

A useful hint concerning the enlarging easel appeared in *The Amateur Photographer* for November 1st, 1910. The writer pointed out that, as a rule, the enlarging easel is either painted white or covered with white paper. Consequently, when the whole of a negative is projected on to this white surface and we wish to use only a portion of the negative for the enlarged picture, it is not always easy to see how the selected part will fit the piece of paper that we propose to use for our picture. Again, the selected part being surrounded by other parts may confuse our judgment.

It is a mistake to paste white paper all over the face of the enlarging easel. It is far better to paint it dead black. Then have a series of thin, white, smooth cards cut to such useful sizes as 8×6, 10×8, 12×10, and so on. A couple of pins serve to fix one of these cards to the face of the easel, and enables focussing and adjustment of position to be done without the eye being distracted by the sur-

rounding parts. A pin in the board at each corner of the selected position enables us to lay aside the focussing card and fix up the paper in position, while having the yellow or orange glass cap on the lens.

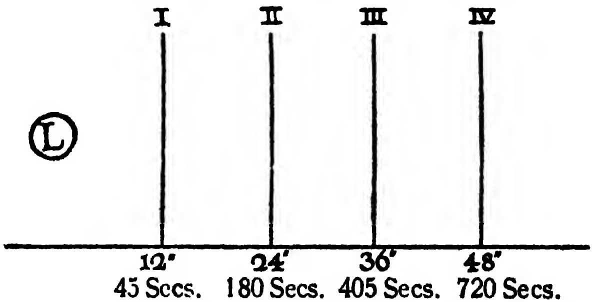
This card system has yet another point in its favour. When focussing on the paper-covered easel, and very sharp definition is required, we have to remember and allow for the fact that the enlarging paper is a trifle in front of the focussing paper screen. But by the card system the paper takes the place of the focussing card. This method does not imply that we must always make our enlargements to these set sizes. It is an easy matter to use the 12×10 card to focus and arrange a "bit" which may measure, say, 11×7. The card, however, tells us what is the smallest cut sheet we can use for any size of picture on the focussing screen or easel.

EXPOSURE.

The most practical method of ascertaining the correct exposure for a bromide enlargement is by preliminary trial on a narrow strip of the paper to be used. All being adjusted, a strip of the paper is fixed in such a position that it crosses characteristic parts of the image, and a trial exposure is given. But often several trial exposures can be made on the same strip of paper, the strip being uncovered by stages. The first trial will sometimes give a sufficient indication as to the right exposure, but the trial method may be repeated until something like certainty is reached. Even when an

estimate or calculation has been made, it is often worth while to confirm by a trial on a strip of paper.

When the correct exposure for any negative is known, the exposure for other size enlargements is easily ascertained, provided the brand of bromide paper, illuminant and aperture of lens remain the same. It is a well-known rule that the intensity of illumination coming from a point and impinging on a given surface is inversely as the square of its distance from the source of light; or, in other words, the greater the distance of the sensitive surface from the lens the longer the exposure.



This is very clearly seen from the diagram here given. Let L be the source of light. If we place the bromide paper at I, 12 ins. from the light, and we find the exposure to be 45 seconds, when we place the paper at II., III., IV. respectively—*i.e.*, at 24, 36 and 48 ins.,—the exposure will not be 45, 90, 135 and 180 seconds, but in the proportion of 1, 2^2, 3^2, 4^2, or 45, 180, 405 and 720 seconds respectively. The above law is not absolutely true for actual sources of light, which necessarily have some magnitude, but the law is a good practical guide where the source of light is small.

MAKING THE MOST OF UNSUITABLE NEGATIVES.

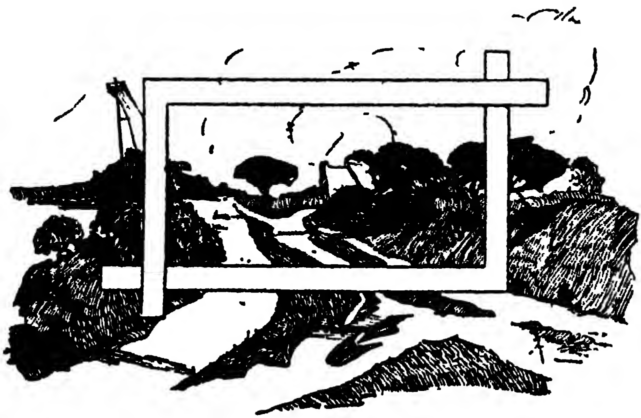
As mentioned earlier in this article, it is quite possible to make a good enlargement from the whole or part of a negative that probably would not yield a satisfactory contact print. This frequently occurs when the negative is thin, partly fogged, or contains so much extraneous material that the actual subject of the picture is overlooked. It will be found, as previously stated, that a thin negative, provided it has gradation and detail, is more likely to yield a good enlargement than a dense or harsh negative. The possessor of such a negative, therefore, who considers it contains the germ of a picture, would be well advised to make a trial bromide enlargement of a portion of it before scrapping it.

By regulating the exposure, in the case of a thin or slightly fogged negative, so as to err on the side of under-exposure, and then using a fresh strong developer, it is frequently possible to produce a brilliant result that will form a good basis, if necessary, for further working up by the bromoil process.

By making a trial enlargement, also, from a small negative that does not appear entirely satisfactory as a whole, one is able to see in the enlargement whether a portion of it when cut away will make a stronger and simpler composition than the entire subject. In fact, it may be stated that a great number of the leading exhibitors of the day utilise portions of negatives in this way for making their exhibition pictures.

A useful way of testing the capabilities of a small

negative for picture-making without going to the trouble and expense of producing a large bromide enlargement, is to make a contact transparency from the negative on a lantern plate, or slow transparency plate, and then project this *positive* image on to the enlarging easel in the same way that a lantern slide is projected. If two L-shaped pieces of black paper or cardboard are now taken and crossed as shown in the diagram, these can be moved



about over the image on the screen so as to mask off certain portions of it in varying sizes until the best composition has been arrived at. The reason they are made black is that the projected image will not show on their surfaces and they make practically a black frame round the portion masked. In this way a very good idea is gained of the part to be enlarged, and a bromide enlargement of the desired subject can then be produced with a minimum of trouble.

VIGNETTING, PRINTING IN CLOUDS, COMBINATION PRINTING, ETC.

It frequently happens that after the desired composition has been obtained it is still necessary to eliminate certain portions that are undesirable. This can be achieved, particularly in the case of portraits, by vignetting, *i.e.*, while the desired portion is fully exposed and retained, its environment is not shown, but the image fades away into the white paper.

To vignette enlargements is not a difficult matter, and for portraits the result is sometimes very pleasing. It is only necessary to take a piece of cardboard the same size as the enlargement is to be, and cut in the cardboard an opening the shape of the desired vignette but *smaller*; it should not be much larger than the lens aperture. The size of the vignette is determined by the distance of the vignetting paper from the sensitive surface, as the nearer to this the smaller the vignette, and *vice versa*, the nearer the lens the larger the vignette. The edges of the vignetting opening in the card need not be serrated, as the vignette is softened by keeping the card constantly moving between the lens and sensitive surface.

Enlargements of landscapes are always improved by the addition of clouds, and if these are non-existent in the negative a separate suitable negative should be used. There are several methods of inserting clouds. One is to make a small transparency by contact printing from the negative to be enlarged, and make a transparency of the cloud

negative, masking out the landscape. The two will then be bound film to film, care being taken that the clouds are not reversed in lighting, and then an enlarged negative made from this. Another method is to make a silver print from the small negative and carefully cut out the landscape, allowing the two pieces of the silver print to blacken completely in the sun. Then fasten the landscape print on to the original negative, or else paint out the sky with some opaque colour. Having focussed and exposed the landscape negative, cap your lens with a piece of orange glass and carefully adjust the cloud negative till it is in exactly the same position as the first negative and the outline agrees with that of the view, which may be marked at the edges of the sensitive paper. Then expose.

Another method is to expose as usual for the landscape, develop and wash; then, without fixing, place again on the easel, and, with the yellow cap on the lens, focus the clouds from the cloud negative and adjust till in correct position; then cover up the landscape with a mask cut from ruby paper and expose for the clouds. The exposure for clouds should be very short, so as not to make them too dark and prominent—practically about one-fourth of the exposure required for the view will be correct for the clouds. Trees, church steeples and other objects projecting into the sky may be practically disregarded, as these will print over the sky and give a more realistic effect. To prevent too sharp a line of demarcation, the mask or a sheet of cardboard cut roughly to shape may be gently moved up and down near the sensitive surface to shade the landscape into the sky.

Yet another way is first to focus the landscape and then expose this portion of the picture on the sheet of bromide paper. At the same time, shield the sky portion by means of a piece of cardboard moved to and fro between the lens and the easel during exposure so as to produce a soft vignetted edge. Then, with the yellow cap on the lens, mark with black-lead pencil on the bromide paper the boundary of the landscape, also mark on the back of the bromide paper with a cross which is the "top," Then remove the bromide paper to a safe place and re-focus the cloud negative, choosing the required portion to fill the exact space desired. Replace the yellow glass cap and pin up the bromide paper again so that the image of the clouds now fills the sky portion of the print. Then give the necessary exposure to the clouds, but this time shield the landscape with the same piece of cardboard used as before. A preliminary trial exposure may be necessary, as generally a cloud negative requires a much shorter exposure than a landscape. If the print is now developed, there should be no line of demarcation visible between the sky and the landscape, which should develop up evenly as one complete print.

SIMULTANEOUS PRINTING AND DEVELOPMENT IN MAKING ENLARGEMENTS

A method of developing bromide paper while exposing on the enlarging easel, so that the correct exposure is actually dependent upon the completion of development, was described in *The Amateur Photographer* for March 8 and April 19, 1910.

The image is first focussed on the easel as usual, but in this case the surface of the board is covered with white American cloth or white opal. The yellow glass cap is placed on the lens, and a piece of bromide paper is treated thus :—

A developer is made up according to the following formula :—

A.	Hydroquinone	180	grains	10 grams.
	Metol	160	,,	9 ,,
	Potassium bromide	30	,,	1·5 ,,
	Sodium sulphite	1½	ozs.	37·5 ,,
	Water to	20	ozs.	500 c.cs.
B.	Sodium carbonate ..	3	ozs.	75 grams.
	Water to	20	ozs.	500 c.cs.

For use, take 2 ozs. A, 2 ozs. B, and 1 oz. pure glycerine. The bromide paper is soaked in this developer for two minutes and then applied to the correct position on the enlarging easel. It will stick to the surface without further attention. The lens is then uncapped, and the exposure and development will proceed automatically together. If the negative is dense, or the exposure otherwise prolonged, fresh developer can be gently brushed on to the wet surface of the print from time to time with a camel-hair mop.

The progress of development is observed by covering the lens for a second or two with a piece of ground glass (ground *yellow* glass is best). When development is complete the print is simply stripped off and placed in the fixing bath as usual.

INTRODUCING PICTORIAL EFFECT WHEN MAKING ENLARGEMENTS.

In ordinary circumstances, particularly if a powerful illuminant is employed, it will be found

that the direct enlargement on bromide paper from a sharply defined snap-shot negative will give a result that is inclined to harshness, and possessing an unsympathetic quality that is decidedly *not* pictorial. This is due largely to the fact that the lens fitted to the majority of the modern small hand cameras is of so short a focus that nearly all the planes of the picture are clearly defined with equal crispness. This harshness of outline appears to be intensified when the enlargement is made, and the eye is in consequence offended in the large picture, when it is sometimes seen that the details of the foreground are as sharply defined and of the same tonality as the most distant hills. If the picture had been taken direct on a large plate in the first place, with a long-focus lens, this lack of recession of planes would not have occurred, but the distance would have been softened considerably by being out of focus.

For certain purposes, of course, the sharpness of all the planes of the picture which the enlargement from the little negative gives will not matter. This is the case when a bromoil print is to be made from the bromide enlargement, as then a certain degree of aerial perspective can be artificially introduced by lightening distant planes and strengthening near ones.

BOLTING SILK.

If, however, a straight enlargement is being made that is to have certain pictorial attributes and prove attractive to the artistic eye, this hardness of

outline and lack of aerial perspective which many bromide enlargements show has to be modified by some means. There are many ways in which this can be done. Possibly the most popular method, and one that is generally advocated, is the use of bolting cloth or bolting silk. This is a very fine-meshed fabric, obtainable from most large photographic dealers. A piece of this, say, about half a yard square, should be stretched on a light wooden frame by means of drawing-pins and kept handy near the enlarging apparatus for use when required.

To use the bolting silk, it is placed at varying distances between the lens and the enlarging easel during the course of exposure. If it is placed quite close to the bromide paper, the fine mesh or pattern of the bolting silk will imprint itself on the paper, and if it is not moved during the exposure a very fine pattern will appear with the image, while if the bolting silk is kept moving during exposure and still fairly close to the bromide paper, this sharply defined pattern is not visible, but a slight blur is introduced that is very pleasing. The blur can be intensified until the entire picture is quite shadowy in character by increasing the distance of the bolting silk from the enlargement and bringing it closer to the lens; and in the same manner, by keeping it in motion a slightly different effect is obtained from that shown when it is kept stationary.

In either case, a certain amount of diffusion is introduced which is very pleasing, and a quite hard negative can be made to give a soft and attractive result by its aid. It should be noted that the use of bolting silk increases the exposure about one-third.

SOFT-FOCUS LENSES AND DIFFUSION OF FOCUS.

Another method of introducing pictorial diffusion when making the bromide enlargement is to use a soft-focus or semi-achromatic lens for making the enlargement. And, of course, it is possible to produce an effect softer than the usual by throwing the image a little out of focus. This method can also be applied to some advantage if the subject is one in which the various planes are fairly well marked in horizontal bands across the picture, as is frequently the case with some landscapes. In this instance, focus the entire negative as sharply as possible, and expose the foreground portion only, shielding the middle distance and distance during the process as suggested when printing in clouds. Then cover up the entire piece of bromide paper with a sheet of thin card and throw the image slightly out of focus. With the aid of two pieces of card, now shield both the foreground and the sky which is to be still further out of focus. If the masking has been properly done, the resulting print should show a recession of planes approximately similar to what would have been obtained with a long-focus lens and a big plate in the first instance.

CORRECTING DISTORTION.

Many negatives of architecture, street scenes, or other objects in which buildings with vertical lines appear, will be found to have these lines anything but upright. This is a fault in the taking of the negative with a camera that has either not a swing back or in which the swing back has not been used.

The defect most frequently takes the form of the vertical lines converging towards the top, and is produced when the camera is pointed up to include the roof, etc., of a high building. The enlarger is extremely useful for correcting this distortion when making the enlarged print, the correction being secured either by swinging the carrier containing the negative so that the lines of the image are again brought vertically upright on the easel, or by leaning the easel so that the same result is obtained.

DEVELOPMENT OF ENLARGEMENTS.

After the bromide paper has been exposed, its development and after-treatment is practically the same as for small bromide prints, which will be found described in another chapter.

Dishes sufficiently large to take the bigger prints are necessary. Yellow or orange light is, of course, used in the dark-room lamp, and if the enlargements are over whole-plate size and full strength developer is employed, it is as well to flood the print first with water before proceeding with development, otherwise there may be risk of development markings. The water is poured off again and the developer is then applied. One of the best all-round developers for bromide enlargements is amidol, for which the following is a reliable formula :—

Amidol	60 grains.	or	3·5 grams.
Sodium sulphite (recryst.)	2 ozs.		50 ,,
Potassium bromide	10 grains.		·5 ,,
Water	40 ozs.		1000 c.cs.

This produces fine black tones, but should be used fresh, as the solutions will not keep in good condition longer than two or three days.

Metol-hydroquinone, rodinal, adurol, and almost any other developer that is clean-working is capable of giving good results on bromide paper, although it will be found that the above formula is probably as good as any. Various formulæ for bromide paper developers will be found in the chapter on "Bromide Printing."

A fixing bath of 3 ozs. hypo to the pint of water is a suitable strength for bromide enlargements. An acid fixing bath will tend to keep both the solution tion and the prints clear and can also be recommended.

The question of washing enlargements may present difficulties to the amateur photographer and to others who are not well equipped in the way of dark-room accommodation. The simplest method, and probably the best, is to use the same large dishes in which the prints have been developed. It will be well, when starting development, to have three dishes, one for plain water, one for developer, and one for fixing solution. Give the enlargements a series of changes of water at intervals of five minutes. If the enlargements are turned over so that the bottom print is constantly brought to the top and the water is changed about half-a-dozen times, it is possible in the course of half an hour to thoroughly wash six big enlargements quite satisfactorily. The process can be expedited by using two dishes of clean water, passing the enlargements from one dish to the other, one at a time, and allowing each print to slightly drain before putting it into the second dish. The first dish is emptied and filled again with fresh water, and the process

repeated until the prints have been changed six or eight times.

The simplest way of drying the enlargements is to use wooden or metal clips sold for the purpose, and hang them from a stout piece of string stretched across a room near the ceiling. If the prints are surface-blotted first and are hung in a warm room, such as a kitchen, overnight, they should be quite dry in the morning, and by passing a long flat ruler over the back they can be flattened out ready for mounting.

PICTORIAL PHOTOGRAPHY.

BY

(THE LATE) A. HORSLEY HINTON.

(The following is a slightly abridged and modified version of the article which appeared in the first edition of the "Barnet Book of Photography." Mr. Horsley Hinton did an enormous amount of work, both theoretical and practical, to encourage the serious practice of pictorial photography, and his influence is felt to this day. The illustrations are not from the original blocks, but from sketches made from the reproductions in the first edition).

UNLIKE most of the other subjects in this book we are not brought to consider, in the case of "pictorial photography," one of the many processes which go to make up the photographic craft, but merely a special and exceptional application of any and all means known to the photographer.

The particular end to which this application is made will be explained as far as the limits of space will permit, and some of the methods of such application will be described. It is for the photographer who has already formed a desire to give his attention to the pictorial side of photography and who is seeking help, that this chapter is designed.

First let us come to an understanding as to the term Pictorial Photography. Picture-making by photography would perhaps be a simpler phrase, but

that to my mind the word "picture-making" is too similar in idea to boot-making, lace-making, etc., all of which imply a mechanical manufacturing, whereas a picture—a real picture—like a musical composition, a poem, or a beautiful thought, grows or is evolved rather than made to order.

Art photography would be a better term, but that in photography the word "art" has been so often coupled with things the very antithesis of artistic, and might hence be misleading; moreover, the photographer will show discretion rather than weakness if he be not too hasty to claim for photography a position among the arts, and whilst its claims to that dignity remain as yet in dispute, we may be content with "Pictorial Photography" as a less assuming title, yet one which will successfully differentiate between what we call the ordinary photographic production and—well, what?

That is the first thing I have to try to explain.

Take an ordinary commercial photographic view such as one may purchase from any seaside stationer. In this case we feel some satisfaction at being able to recognize a familiar spot, or the view reminds us of some other place, or it may be that quaint buildings, or rugged mountains, or miles of foliage, or what not inspire curiosity, or interest, because we know the photograph to be a true record of facts; that is to say, we accept the photograph in lieu of the actual presence of the objects represented, and experience nearly the same feelings as we should were we to visit the spot represented. We know that the wonderful, curious or unusual things portrayed have an existence, otherwise we could not have a photograph of them.

In all such cases our interest and value of the photograph would vastly diminish were it possible for a photograph of this kind to be made simply by the photographer's hand and imagination without any original at all.

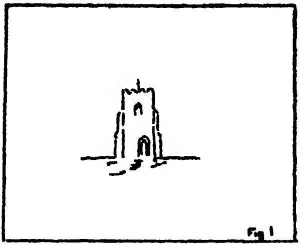


Fig 1

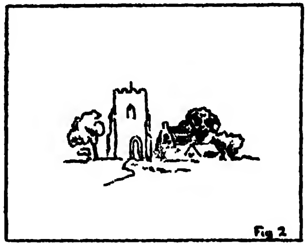


Fig 2

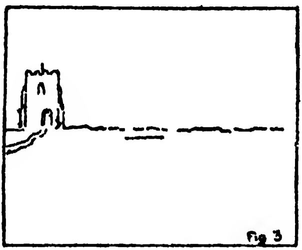


Fig 3

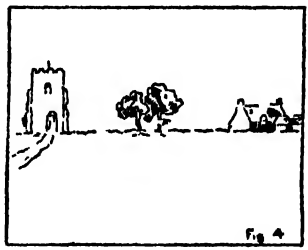


Fig 4

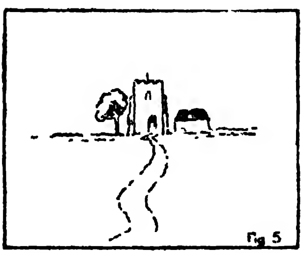
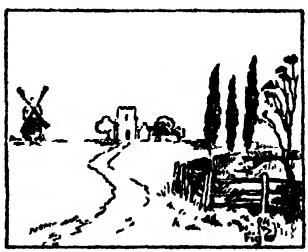


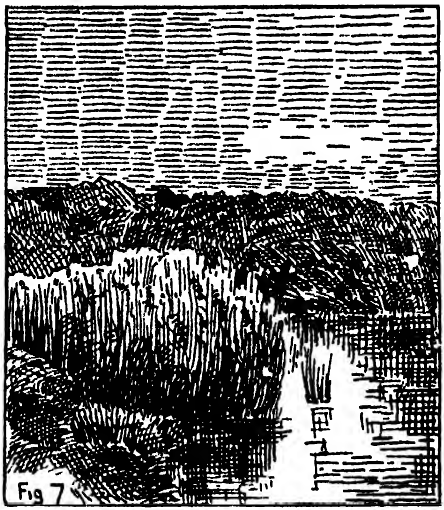
Fig 5



Fig

You look at a photograph of this or that seaside place and remark, "Ah, yes, that's dear old Yarmouth; many a time, etc., etc." or else, "Dear me, I wonder what place that is, it's so like——" such and such a town; or it may be you enquire,

"Where's that?" and you express or think to yourself you would like to go and visit the spot. These and kindred sensations are those kindled by the average photograph; but there is yet another, for you may be impelled to exclaim, "How wonderfully clear and bright that photograph is," or



"What a good photograph." In this case you are interested purely in the execution as an example of clever manipulation and skilful craftsmanship.

Now, compare such feelings as these with those stirred by an example of good pictorial work. In the first place your esteem for it, if you value it at all, is quite as great whether you know the place where it was made or not. If it pleases you, that pleasure is not dependent upon the fact that it does represent some place. In the case of paintings and drawings, as often as not they do not pretend to

represent any place at all, but are pure fiction, yet we do not value them the less. To what then is the pleasure we feel when looking at a good picture due? Is it not that a picture stirs up, that is, *creates* pleasant or beautiful thoughts and ideas? By "pleasant" I do not mean necessarily merry

Fig. 8

or joyous ones, for some hearts feel profounder pleasure in the grandeur of storm, or the majesty of the mountain, than in the sweet wilderness of flowery wastes; but notice that such beautiful ideas are *created* by the picture. You were thinking of something totally different before you came upon the landscape picture which instantly made you feel the glowing light, the stirring breeze, and hear the rustling corn and noisy brook; and yet it cannot be said it is because we *recognize* these things in the picture that we receive these impressions; at least it is not the kind of recognition which takes place when we see a photograph of Brighton Pier or Haddon Hall.

Notice, it is not the exact and faithful portrayal of objects that creates the emotions instanced, for if you closely observe the manner in which a good painting is done you will find that rude splashes of

Fig. 9

paint, broad brush strokes and the like, stand for foliage, or water, or corn stalks, as the case may be, when we know that had the painter desired he *could* have produced his likeness of nature with a good deal more of the precise detail and fidelity to outlines which photography excels in, *had he wished.* But if the painter or other pictorial artist needs not

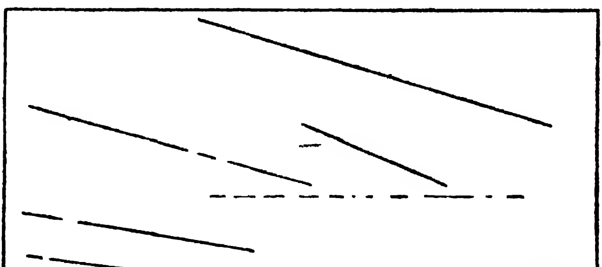


Fig. 10.

to trouble about accuracy of details to secure the effect aimed at he must be faithful to general facts. There is a great difference between not recognizing things or having no particular wish to do so, and

feeling conscious that a portrayal is so utterly unlike anything in our past experience of nature that we should not recognize the objects even if we *were* acquainted with them. To take an extreme case:

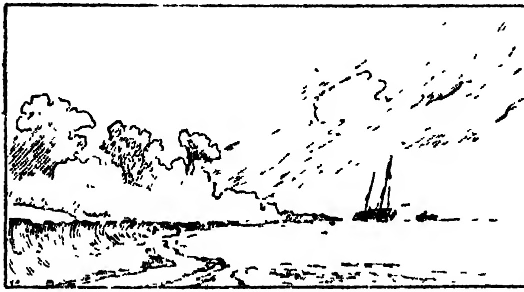


Fig 11

our enjoyment of the effect and sentiment of a beautiful landscape picture is not enhanced by our being able to recognize whether the trees are oaks or elms, but it would be distinctly disturbed if the palm trees were represented as growing on the slopes of a Welsh mountain. Innumerable examples and instances might be given to show that the artist,

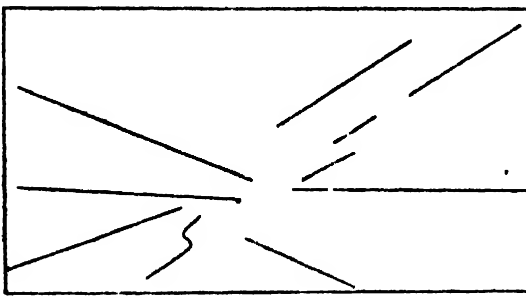


Fig 12

whatsoever his medium, be it colour or monochrome, may depart from truth, or may be indifferent to precise details, *only so far as he avoids palpable untruth.*

Why is this ?

When we look at a powerful and impressive picture we feel at once the sentiment ; our emotions are at once stirred ; subsequently we recognize objects and facts portrayed, but only when we begin to look for them or think about them ; but a gross

exaggeration or a very obvious error strikes us at once before we begin to receive sentiments and ideas and that error or exaggeration once seen is never lost sight of, and whole enjoyment of the picture is hopelessly marred.

Now from the foregoing we may formulate the broad definition that a picture does not depend for its excellence on the faithful representation of objects, and is not chiefly valuable on account of our immediate recognition of things portrayed, yet on the other hand it must not let us feel that there is obvious inaccuracy.

Here then we have now opposite positions, in both of which the mere objects employed to build up the picture are subordinated to the effect or impression of the picture. In one case the spectator

must not be allowed to feel that the representation is *wrong;* in the other, success will not directly depend on the representation being very *right;* neither startling rightness or truth, nor the obvious wrongness or untruth should thrust the objects comprising the picture upon the beholder's attention;

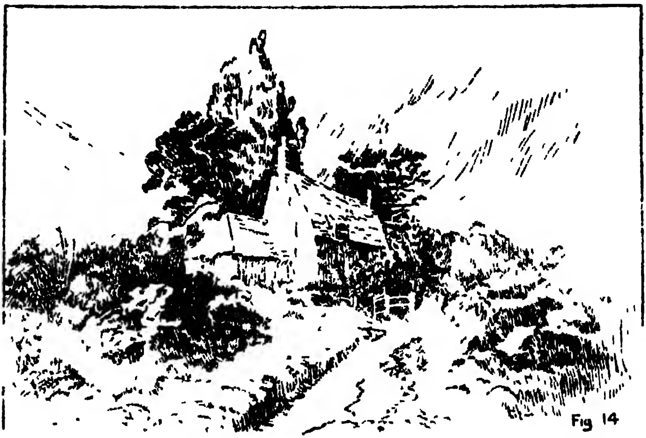


Fig 14

he should be left free to receive the impression or sentiment of it.

I have, in other pages, suggested that obvious violation of truth will prevent the sentiment or effect of the picture from being paramount, and now I will submit that an excess of accuracy to detail is equally detrimental to the success of a picture *as* a picture.

If by now the reader is prepared to admit that [illegible] purpose of a picture is the feelings, emo- [illegible] ideas which it suggests or creates, and not [illegible] objects it portrays, he will be able to go further and perceive that in a landscape (for instance) cottages, trees or what not are introduced, not for

their own intrinsic interest, but as vehicles of light and shade, which go to express the picture's sentiment.

If we stand before a good picture with closed eyes and suddenly open them, our first impression (excluding any question of colour) is that of masses

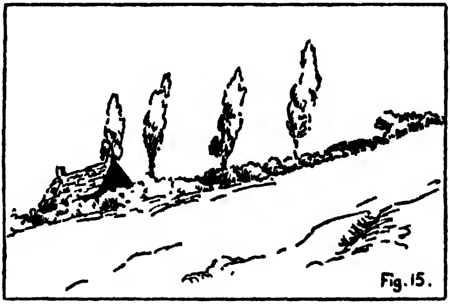


Fig. 15.

of light and shade pleasingly and harmoniously arranged; if we retreat to such a distance that the objects constituting those lights and shades are unrecognizable, the balance and pleasing arrangement should still be felt, and our æsthetic sense is satisfied, although we do not see fully of what the picture is composed. This is the quality which is termed *breadth*, and is admittedly of very great value.

On the other hand, if the shadow masses are filled with innumerable details, and are thus broken up into tiny lights and shadows, they no longer exist as broad masses of dark; but if before retreating as proposed from the picture the lights or shadows appear so blank as to prompt particular investigation, and upon examination we find detail absent which we know must have been present, then we encounter an instance of untruth and exaggeration

which is obvious and which disturbs our appreciation of other fine qualities. Thus we require *sufficient detail to avoid giving the idea that detail is left out.*

The delineation of sharp outlines and redundance of detail is not wrong in itself, but it is usually inexpedient when considered with respect to the

Fig 16.

effect to be produced; similarly the suppression of sharp focus both as regards outlines and details has no artistic merit of itself except as it assists the picture to impress the beholder first with the general effect.

The painter and the photographer start from two opposite standpoints. The painter, or draughtsman, starts with nothing but blank paper, and having built up his picture and produced his desired effect he elaborates no further; the photographer

with his more or less mechanically produced *facsimile* starts from the opposite extreme with a transcendentally elaborate image, from which he will require to eliminate all such excess of truth as is likely to force the mere facts of the view upon the beholder's attention.

Fig 17

Fig 18

Photography, so faultlessly complete in its delineation, gives us *more than the pictorial worker needs for the expression of an idea ;* and this is why I would remind the student that pictorial photography is not photography in the full sense of the word, but the application of its powers—just as much as we need and no more—to a definite end.

As just hinted the purpose of a picture is to express ideas ; hence I will fall back on a kind of definition which I have previously used, that a picture is the portrayal of visible concrete things for the expression of abstract ideas.

To give an example by way of exposition we may look upon a picture and be made to feel by it the calm and luminous atmosphere of evening; we feel at once the restfulness, and almost feel the warmth of the humid air, giving place to the chill gathering mists of night; but the same objects, the same tangible materials, paper, pigment, metallic salts, etc., in another picture give us the sense of angry turbulent storm, or perhaps bright joyous sunshine frolicing with the fresh breezes on the hill-tops. These are abstract ideas expressed or created by the manner in which concrete things, commonplace facts, are portrayed and rendered.

Finally, let us enunciate that a very excellent photograph may not necessarily be a good picture, because it may contain more than is required for the expression of its idea, and the surplus will overwhelm it; again, a good pictorial photograph may be but a poor photograph, because if we claim the right to apply photographic means to pictorial ends, we may find it convenient to leave out the very qualities which the scientific or technical expert considers most precious.

And now I think we may proceed to more practical matters.

COMPOSITION AND SELECTION

In all matters from which the eye expects to derive pleasure symmetry of design seems essential. In the formation of the letters that we write, in personal attire, in the decoration of our homes, in buildings, and in practically everything which is not of a purely utilitarian character, a sense of proportion and a symmetrical disposition of parts

are observed. Hence it is no source of surprise that in a picture, which as much as anything else should aim at pleasing the eye, design, otherwise Composition, is with Expression a co-essential.

In a purely decorative production this natural desire of design is the only thing to be observed, but in a picture which *may* be decorative, but *must* be something more, we have expression as well to consider. If decoration alone were to be regarded something like fixed rules might perhaps be tyrannically laid down, but in a picture the implicit observance of rules of composition would be certain to make itself seen in the result, and the undue obtrusiveness of a code of rules would be as inimical to the supremacy of ideas and feelings as the excessive prominence of fact would be, which has already been described.

Hence the difficulty in prescribing any definite course for the beginner, because whilst to most instinctive artistic temperaments a certain knowledge of, or feeling for, composition is natural, so soon as this is reduced to definite rule and given to another, the secondhand use (as it were) is nearly certain to betray itself by its misapplication. I would ask, therefore, that any suggestions given here on the subject of composition should be taken as one takes lessons in the rudiments of a language, which rudiments we violate and forget as soon as we have become proficient enough to speak it. *Such rules in composition should be observed only so far as to avoid the appearance of having infringed or ignored them.*

The rules of composition which may be found to apply in one of the pictorial arts must necessarily

apply equally to the others, and so, therefore, to pictorial photography, which at least aspires to be considered as an art. If on a sheet of paper a rectangular space is given us wherein to draw the likeness of anything, the most natural course to pursue would be to draw that figure in the centre or thereabouts, and if then we are asked to add the likeness of two or three more objects we should naturally place these near the first object. Thus should we compose a group of objects which draw the attention to the middle of the picture or space.

Suppose we are asked to draw the picture of a church tower we should probably comply with the request somewhat as shown in Fig. 1. Next we will suppose we are asked to add a cottage, some trees, and a path to the church, we should, if possessed of some sense of symmetry and order, coupled with average intelligence, make the additions somewhat as in Fig. 2. It would surely be an unusual thing to follow instead the course suggested by Figs. 3 and 4.

In Figs. 1 and 2 we have instinctively placed the primary object in or near the centre, and the others near and around it, and the result strikes one at once as being better composed, that is, more symmetrical, than in Fig. 4, in which amongst other things one is not sure which object to regard as the principal one; and one also feels that but for the boundaries of the picture left and right we might have seen a good deal more beyond, which would have added to the interest of the picture.

In this we have one of the first rules in composition, *viz.*: that the principal object should be near the middle, and the next important one near to, and

as it were supporting it, and no object likely to attract the eye should be so near the edge of the picture as to make us instantly conscious of the boundaries and wish to see more beyond.

But now if in compliance with the supposed request we had made our drawing as in Fig. 5 it might at once be felt by the observer that we had put the objects in a central position *intentionally*, which is equivalent to saying that we had allowed our endeavour to observe the rule just laid down to betray itself. Fig. 2 is preferable as being only just sufficiently symmetrical to avoid being unsymmetrical, which is an example of what has already been said about the necessity of observing rules of composition just so far as to escape the appearance of having broken them.

If this rule is right as regards voluntarily drawing a picture, it is equally so in the case of a photograph, but instead of deliberately placing things in such and such positions we attain the same end by moving the camera and selecting our point of view so that the objects come into the positions desired.

Now suppose, then, we have done this, but in doing it we are quite unable to prevent other objects coming into the field of view and occupying undesirable places near the margins of the picture, as for instance in Fig. 6. Here we are brought to consider another rule or principle in composition, *viz.*: that there must be one and only one chief object in the picture; whereas in Fig. 6, apart from the gate and tree on the one side and the windmill on the other attracting attention to the margins of the picture, these same objects arrest the attention quite as much as does the church, and we feel the

eye wandering about from one to the other and missing the sensation of centralization and rest which Fig. 2 gives.

If we were drawing or painting we should put in what we want and then stop; we should omit, or ignore, what we did not require; but in photography our powers in this direction are limited, and hence we must as far as possible select those views, and only accept such, as comply with what we feel to be right.

The angle of view included by different lenses is an auxiliary not to be neglected, for by substituting a narrower angle lens, that is, one of longer focus, we may cut off or leave out undesirable objects which the shorter focus lens might include. Then again, when the print is finished we can after careful consideration cut off what would have been better left out, for it will be better to have a picture half the size well composed than double the number of inches with a distracting and unsatisfactory arrangement of objects; hence with many most successful workers it is no uncommon thing to take quite a small portion of a negative, and either print it as it is or enlarge it up to the desired size, but mere size will reckon as nothing as compared with pleasing composition.

It is inexpedient to let the principal object, or group of objects, occupy the exact centre of the picture measured from left to right; it is equally so if the centre be measured from top to bottom; and hence we may formulate the rule (to be broken perhaps later when we are strong enough to be independent of guiding) that the horizon should not be allowed to come midway between the top and the bottom of the picture.

Remembering now that, as set forth in the earlier part of this article, a picture should appeal to our feelings and stir our emotions, it may be pointed out that in most ordinary things, and certainly in the arts, the most powerful are those which possess *one* dominant idea or feature, as in a piece of music the refrain keeps recurring, a preacher takes a text, in a story there is *one* hero, and so forth; and in point of composition Fig. 7 is better than Fig. 8, although the view is less comprehensive.

It may not, however, always be easy for the beginner to determine what is the chief object which should occupy the central position, or which object or group to choose in a landscape.

This brings us to speak of another important matter, and that is the right disposition of lines which form the view, or the selection of view, so that the lines formed by the component parts shall fall in a desirable manner. The various objects in any view tend to form or suggest lines. Thus in Fig. 9 the outline of the trees, the bank along the shore, the clouds, and the boats, suggest the lines shown in the diagram Fig. 10, which lines all run the same way; but in Fig. 11 we have a similar view in which the lines suggested counterbalance each other, and not only so, but by their convergence they carry the eye to a spot near the centre, and so make the boat, although not very large nor conspicuous, the one and principal object (diagram Fig. 12).

For the sake of training one's perceptions, look at any good pictures, and in your mind resolve them into line diagrams and see how these lines fall; and in considering any landscape or other subject to be

INDOOR PORTRAITURE

By [illegible]

photographed make up your mind as to what lines are suggested, and then select your point of view so that these lines balance or are symmetrical in arrangement, and also that they converge towards some point well within the picture, and near the centre of it.

In Fig. 13 we have a subject in part well composed. But the composition is spoilt because of the line formed by the road and fence, which seem to cut the [illegible] two; whereas could we have chosen [illegible] from a point of view giving such an [illegible] Fig. 14, a difference is at once [illegible] more pleasing effect gained.

Lines [illegible] to separate us from the picture and cut [illegible] one part from another should be carefully avoided, and [illegible] can [illegible] find something which will, as it were, lead the eye into the picture, should be made, and [illegible] object, however it may interest us, must often be abandoned if it lacks those things which go to make pleasing composition; remembering, [illegible] we should always do, that in pictorial work the fact that objects are curious, or interesting or pretty, has nothing to do with the case, but that they are only to be valued according as they act as media for expressing pleasing ideas, beautiful thoughts and sentiments, which they will not do if some part creates a feeling of unpleasing arrangement or design. If a scene does not compose well we should, as pictorial workers, feel no desire to reproduce it. But, you may say, "Cannot we often by changing our point of view get an otherwise ill-composed subject to compose well?" Most decidedly; that is precisely what we *should* do, but it is no longer the same subject or view.

And now let me say that it is often surprising how much alteration may be made by changing our position. Figs. 15 and 16 are together an instance of this, the outline here given being drawn from a pencil sketch made on the spot; whilst Figs. 17 and 18 are examples of the desirable change brought about by watching and waiting for a change in the position of light, and the condition of the river's tide.

Where the beginner most often fails is in taking things as they are without pausing to consider whether they might not be improved, and if so in what way; and then patiently searching to see if such better way can be found. Pictorial success will as often as not depend on the exercise of fastidious taste, which is satisfied with nothing but the very best, and not quite content even then.

A great deal more might usefully be said with reference to the composition of lines if space would permit, but the following may be given as a sort of summing-up. If the disposition of the lines constitutes such a perfectly symmetrical design that it is at once recognized as symmetrical, then it is wrong, because the artifice by which pleasing composition is attained is betrayed, and we feel the thing to be artificial. If, on the other hand, the lines fall so as to make the beholder conscious of their presence, as, for instance, cutting off a portion of the subject, or presenting a one-sided appearance, again it is wrong. *In neither case should the lines or the objects suggesting them be felt at all until sought for, neither as being very right nor very wrong.*

In art it is a maxim that the means by which a thing is done should not proclaim itself; and hence it must apply to pictorial photography, which is an

effort after the artistic. A composition should please without our quite knowing why, and without our being able to see the machinery, as it were, by which our pleasurable sensations are set in motion.

But whilst it is convenient to speak of *lines* in the landscape, it is only a manner of speaking, for, as we know very well, photography, unlike pen drawing, has to do with "tones," that is, *masses* of light and shade. Now the general rules suggested as regards the arrangement of lines apply in much the same way if we regard a picture (as we should do) as consisting of masses of light and shade.

If when standing before a picture we close the eyes and then suddenly open them, our attention is certain to be drawn to the highest light or the deepest shadow; and hence, as a general rule, whichever of these is the strongest to attract attention should be in or near the principal object—indeed it will make of itself the principal object—and should, therefore, be well removed from the margins of the picture.

Refer again to Fig. 8, in which the light patch of sky, the light in the water, and the two clusters of light rushes, all form competing points of attraction; and if these are too near the margins they remind us of those margins; hence the improvement when those are cut away or left out. But disposing of the highest light and deepest dark does not finish the matter. There is a certain relative degree of lightness and darkness between everything in nature. Moreover, colours have to be interpreted by certain degrees of light and shade according to the distance objects are away from us, and according to the amount of light falling on them.

Such relative lightness and darkness is called *tone*. The word used in this sense has nothing to do with "tone" as applied to the colour of a print, which colour we change by a process we call "toning"; and upon the correct rendering of relative tones much of the effect of a picture depends, and much of its emotional qualities. Generally speaking, although there are often exceptions, the further an object is from us the greyer it seems. White becomes less white, and dark objects grow less dark, until in the distance both, under ordinary circumstances, come almost to the same tone, and we see the distance only as a grey hazy mass.

Every corner of nature's broad expanse is, as it were, enveloped in atmosphere, and invisible as we are commonly in the habit of considering it to be it affects to a greater or less degree everything we see; and the visible atmosphere is often responsible for some of nature's most beautiful and appealing aspects. Obviously then we cannot afford to leave out so important a contributory to picturesque effect, and it is on this account rather than on account of sharp or unsharp detail that the question of stops and lens apertures comes in. Look at the image of a landscape, on a moderately hazy day, as it appears on the ground-glass focussing screen of your camera, using the lens at full aperture—then quickly insert f/32 and notice the difference. Not alone have objects near at hand and more remote become more sharply or more evenly defined, but you may also notice that objects are *more brilliant*, and that a sense of atmosphere has been cut off. My recommendation is, then, to use a single landscape lens, or the single combination of a doublet, and in starting to use

the full aperture. With this it may be that when the foreground is moderately sharp, trees more remote are so ill defined as to appear as a collection of little blots and irregular patches. Whilst sharp detail in all places may not be productive of pictorial effect, yet the extreme opposite will be displeasing in another way, and it will be best to secure just *so much definition and no more* as shall save the representation from appearing to have been wilfully put out of focus. Once let the destruction of detail be obvious, and again we betray the artifice by which we are working.

Passing reference has been made to the interpretation of colours in nature in their true relative value of black and white. Throughout the whole range of nature the contrasting and blending of adjacent colours is so subtle a thing that I should feel one were throwing away an advantage by not using colour-corrected or isochromatic plates on nearly every occasion; and in order to get the full advantage of these plates I should consider the addition of a yellow screen essential. The rapidity of one's plates must be governed entirely by the nature of the subject, as also to some degree must be subsequent development and printing.

In every case I would endeavour to get a comparatively "thin" negative, with even the portions representing deepest shadows slightly veiled. "Clear glass shadows" is an enormity, and an outrage both of science and art; equally are solid high-lights to be shunned. With modern printing methods it needs much less than actual opacity to produce white paper; and if the picture requires any part of it at all to appear as quite white, no

subject will need more than the very smallest region to be so. A general softness and very subtle gradation, with a total absence of "sparkle" and brilliance in the negative, will yield by at least most processes the most suggestive print, bearing in mind that delicate gradations suggest atmosphere, and atmosphere is one of nature's most precious qualities.

And leaving much more of importance unsaid than space limits admit of my saying, I must leave it.

HOME PORTRAITURE

By

WM. HAROLD HOUSE, F.R.P.S.

(*Illustrations to this article will be found at pages 203 and 219.*)

IT is no doubt a truism that sooner or later (and sooner rather than later) every owner of a camera tries his hand at Portraiture. It is the natural temptation, and there is really no branch of photography which, if properly pursued, can give more satisfaction and pleasure to oneself and one's friends. But the novice's portraits are often a severe test of friendship, and for that reason he is apt to abandon portraiture as too difficult. Success in portraiture demands the same perseverance as, but probably not more than, other branches of photography.

There is an old idea that for good portraiture, a studio is essential, but the work of a number of well-known photographers demonstrates the contrary, and if this article in some measure indicates how good home portraiture may be produced, it will not have failed of its purpose.

Home portraiture for the purpose of this article is deemed to mean such portraiture as can conveniently be done in and about the ordinary house, without any particular facilities (either in the way of a studio or anything else) not usually found in such surroundings.

In the first place it should be said that many of the

requisites of good portraiture are common to the home worker and to the studio worker, and perhaps these can be summed up as good technique, good temper, good taste and tact.

Something more will be said of technique later, but it cannot be too strongly emphasized that the worker's first aim should be a thorough mastery of technical matters, in the production of both the negative and the print. It must not be expected that good portraits can be obtained as a matter of course, or without experiencing numerous failures.

There is always a tendency to take the conventional portrait as a model, and to an extent this is sound, but in doing so without understanding or realizing the difference in conditions the home worker will meet with many disappointments. Convention in this, as in much else, is good as a guide, but not as a master. The conventional lightings—the common 45 degrees for instance—are often commended by general experience as most likely to secure a good likeness, and generally pleasing result. It is well then to let convention guide where judgment approves, but not further, and the home worker will soon find that much pure portraiture can be done on distinctly unconventional lines, and much of it such as can only be done under the conditions at his command.

As has been said it is well to take convention as a guide so far as seems good, but the conventional lightings of the professional photographer are obtained in the studio. In seeking to obtain the conventional lightings in the ordinary room, it will be found that the assistance of a reflector is often advisable, and indeed necessary. The light is

generally concentrated, coming from one window without a secondary light to relieve the shadow side, and a reflector, which may consist of a white sheet, or any other suitable reflecting surface, is then essential. It must be placed with care, as there are several pitfalls to be avoided. It may for instance be so placed that the modelling on the shadow side of the face is destroyed, or so that it causes a pronounced and ugly dark line down the middle of the face. The reflector must, therefore, be carefully adjusted both as to the distance from the sitter, and the angle at which it is placed. So far as possible, however, it is advised that a reflector be *not* used. It will be found that the farther the sitter is from the source of light, the less pronounced will be the contrasts, and the less the need of a reflector. The relative positions of the camera, the sitter, and the source of light, too, considerably affect the result. If the room is a light one, with light wall paper or decoration, a reflector can often be dispensed with by placing the sitter well away from the source of light and so that the light surfaces of the room reflect into the shadows. As mentioned above, one effect of placing the sitter farther from the source of light is to reduce contrasts, frequently with pleasing results, but sometimes with the result that the high light on the face is not strong enough for the subject. If that be so the sitter may have to be placed nearer the window and a reflector used, but a useful dodge, if the sun happens to be shining into the room, is to place a glazed picture or a sheet of glass in the sunshine so that it reflects a strong, concentrated light on to the face of the sitter and gives effective emphasis in an uncommon way.

The conditions of indoor work must, of course, vary in every house, and in every room, and indeed with the furnishing of the rooms. It is surprising how much difficulty is caused to the photographer by ordinary household furniture. It is constantly in the way, and the smaller the room the worse the impediment. A good plan, however, with suitable subjects and suitable furniture and surroundings, is to make use of the ordinary domestic arrangements if possible. If this can be done it will not only save trouble at the time, but the result will probably be more pleasing. It will not be a conventional portrait, but the subject at home.

It has often been said that portraits should not be taken with the light behind the camera, or against the light. These are two instances where the home worker will do well at times to depart from convention, but he must do so realizing that he has technical difficulties to overcome. Very soft pleasing portraits with good modelling can be obtained by placing the subject opposite the window, and with the light behind the camera. Sometimes the worker may be fortunate enough to have the sun shining right across the room on to the sitter with attractive results. If the wallpaper is inoffensive it will provide all the background necessary. It may be plain, or one of the pleasing tapestry patterns which are now in favour. If it is not suitable some other background must be substituted. As to backgrounds generally more will be said later. Portraits against the light are a very different problem, but one well worth solving. If the room is lighted with only a flat window, this class of work cannot be done without the aid of a reflector; and

indeed, if taken directly against the light under these conditions, there is considerable risk of the likeness being lost. If. however, the aim is not portraiture, but a figure study, this is immaterial. If a reflector is used it must be so placed that it is not itself reflected in the window behind, as may sometimes happen. Besides the vertical reflector, it may be helpful to put something light on the floor on the shadow side. If the room is lighted with a bay window, or with two windows at different angles, then the technical difficulties are not quite so great, and attractive unconventional portraits can be obtained. If the room is one into which the sun shines, the use of sunshine may add to the charm of the picture, as it certainly will to the technical difficulties. Do not be afraid of this, however. In working against the light halation and fogging of the plate must always be guarded against. Backed plates are essential.

Home Portraiture need not by any means be confined to the house, and indeed, the writer prefers to work out of doors. There is practically no limit to the variety of the results obtainable out of doors, and speaking generally, it is more convenient. There is, of course, the drawback that one is dependent on the weather, but, subject to that, the results need be in no way inferior to those obtained in the studio, and the play of sunshine is of unending interest and charm, and such as no studio can afford.

There is a widespread belief that outdoor portraits must suffer from certain well-known defects, though in recent years that belief has been gradually becoming less common. Two common faults in outdoor portraits are flat lighting and an excess of

top light. Flat lighting can always be avoided (if desired) by a little care and observation in placing the subject, and if there is an excess of top light it can be overcome by screening the top of the head—a friend holding a sheet of cardboard or an old box cover or umbrella over the sitter's head; or any equally simple arrangement will serve.

Perhaps the best light for general portraiture is that obtainable at about sunset, fortunately a time which is the most convenient to the majority of workers.

When working out of doors, speaking generally the more space one has the better, but it by no means follows that a large garden is necessarily the best for portraiture. The smallest of backyards will serve, and if only that backyard be open to the west, a better place could hardly be found. No better lighting could be desired than that obtained by placing the sitter so that the light from the setting sun, or from the western sky, even though the sun be a little below the horizon, is on his face. Sometimes if the sunshine is too brilliant it may be diffused by interposing a piece of muslin held by a friend, or hung over a clothes horse, but this will seldom be found necessary. Sometimes too it may be advisable to place something to shade the lower part of the figure, to give more concentrated lighting. A great variety of lighting can be obtained by changing the positions of the sitter and camera respectively, and touching the use of a screen for excessive top light, it will be found that the need of this will vary with the nature of the surroundings, and the angle and strength of the main source of light. In circumstances where the western light

is not available, or when working at times of the day other than the evening, the worker will need to observe how figures placed in different positions are lighted, remembering that the nearer the sitter is to the side of a building, or anything else shutting off the light, the more that side of him will be in shadow, and the more nearly the light comes from behind the camera the flatter the lighting will be.

But the greatest charm of outdoor portraiture begins when direct sunshine is brought into use. It of course increases the difficulties, but it extends the possibilities beyond conception. There are many pitfalls, and it is possible to name only very few of them. One of the first is the sun shining on the lens. It is a point quite easily overlooked, even when one is experienced, but if the sun is so shining at the moment of exposure, it means a fogged plate and failure. The remedy is to shade the lens A lens hood is useful, but anything held to shade the lens will answer the purpose. When working against the light, however, with the low evening sun it will generally be necessary to place the camera so that the lens is in shadow. The shade of a tree or building will often be available. Another trouble, and one more difficult to meet, is the sun shining in the sitter's eyes, causing them partially to close up, as well as giving discomfort to the sitter. The sitter must be placed to avoid this, or if he is being taken with his hat on, that may afford a remedy. Children may often be taken so, and sometimes ladies and men, but the possible result of changing fashions has to be borne in mind.

There remains to be considered portraiture by artificial light. This is a phase of portraiture of

considerable attraction and interest, and very useful on dull days and dark evenings. The present-day facilities for electric light and incandescent gas, too, widen the possibilities for this class of work.

No up-to-date studio is without a special fitting for portraiture by electric light, but these contrivances are too costly and, generally speaking, impracticable for the home worker. There are many ways, however, in which interesting and good work can be done by quite simple means. The best known method of artificial light portraiture is probably flashlight, and with this is commonly associated an unpleasantly harsh result. There is no reason why this should be so if care be taken. The same attention should be given to the position, quality and quantity of the light, and the relative positions of the light, sitter and camera, as for daylight. It is usual to use a flash lamp or flash-light mixture, but magnesium ribbon may also be used, though it necessitates a longer exposure and so to some extent limits the choice of subject. The position in which the light should be placed depends upon the result desired (and a warning similar to that already given as to sunshine should be repeated—the light must not shine directly on the lens), but the best position probably is to place the light at an angle of about 45 degrees, not lower, and preferably rather higher, than the sitter's face. The light should not be too close to the sitter, and if brilliant must be diffused, or the result will be harsh. The same care must be exercised in the use of a reflector as has already been suggested for daylight portraiture.

Good portraits can also be obtained by the use of the ordinary gas or electric light, if the room is well

lighted. If electric light is available and fitted with fairly powerful lamps, very pleasing lighting can be obtained, but if the light is not already diffused, it is well to diffuse slightly with muslin. As the exposures will in most cases be fairly long, the sitter should be in an easy position to avoid risk of movement. The worker will soon learn by experiment what exposure should be given. This will vary considerably under differing conditions. If there is a secondary light in the room, it can sometimes be used with advantage to help the shadows, but care must be taken to avoid cross lighting.

Under whatever conditions the worker may be working, indoors or out of doors, in daylight or artificial light, he must exercise discretion in the use of backgrounds. In many cases indoors no background is necessary, and is often better dispensed with, but if one must be used then it should be chosen to help the result desired. The subject should never so blend with the background that any part of the figure is indistinguishable. In outdoor portraiture the natural surroundings may frequently be used. Often a natural background is pleasing and effective, or a plain wall may be a boon, especially if it be a white one upon which there are cast shadows. If however, an artificial background must be used, then do not let it be one that proclaims itself. A white sheet is an excellent substitute for a white wall and has the advantage that it can be placed where the shadows fall. A plain background for which a curtain, or any other plain material will serve, is sometimes advisable, but by the use of cast shadows infinite variety can be obtained. They should, however, be used only to help the composition and

not to compete with the subject. On emergency the most unlikely articles may be brought into use and rendered as useful tones in the background by placing out of focus. Care must be taken that there is no strong light reaching the lens over the top of the background as this may cause fogging of the plate.

Photographers differ widely as to the class of negative they prefer, but for portraiture generally the writer aims at a soft yet brilliant one, a result difficult to explain in words. There should be no clear glass, and the highest light should not print dead white, even though it be the brightest part of a sunlit white garment. The exposures should be full. Under-exposure is fatal. Fast plates are best for the purpose. The necessary exposure is shorter, and they do not put on density so readily as the slower plates. A good plan with regard to the developer is to use that recommended by the makers of the plate. For general use, the writer prefers pyro-soda diluted with a double quantity of water. It must be borne in mind that the temperature of the developer considerably affects the results, both as to the rapidity with which the image appears, and the quality of the negative. If under-exposure is feared, a cold developer should not be used, and in the winter it should always be brought to a normal temperature, by the addition of a little warm water.

The question of retouching is a difficult one. It is best to retouch as little as possible. A good deal can be avoided by judicious lighting, full exposure and careful development, but sometimes obtrusive lines must be toned down, harsh contrasts softened and small defects removed. What is necessary

OUTDOOR PORTRAIT IN EVENING SUNLIGHT

should be done carefully to avoid risk of destroying the likeness. Portraits of children, particularly, seldom require retouching, except to the slightest extent.

Now nothing has been said about the actual operation of taking the portrait. It is here that good temper and tact come in. It is entirely a matter of personality, as the operator will soon find out for himself. Some sitters are much more difficult than others, and there is a great deal in the question of affinity between the operator and the sitter. Some people seem to become impossible as soon as they see a camera, and it is then the photographer's temper and tact are most severely tried. He must, however, do his best to put the sitter at ease, without of course making any apparent effort to do so If the sitter has any obvious defect or prominent feature, do not call attention to it if it can be helped He is probably already too conscious of it. The operator must not worry either himself or the sitter, but keep his eyes open, and seize his opportunity. Get all arrangements made before placing the sitter, and then when possible let him pose himself, making necessary slight adjustments. Suggestions can often be made, which do not appear as instructions If the sitter is a "stick," well the sooner he can be disposed of, the sooner he will be a walking stick, and the happier both he and the photographer will be! If a good portrait is obtained, so much the more credit to the photographer

ARCHITECTURAL PHOTOGRAPHY.

By

ERNEST MARRIAGE, F.R.P.S.

(This article contains valuable hints and advice by one who is a recognised expert in architectural photography, and a specialist in telephotographic work. An illustration showing some of the styles of architecture at Dunstable Priory, before its restoration, appears at page 235).

THERE is perhaps no other branch of our art which has stronger claims on the amateur than the photography of old buildings. It is essentially work that can be better done by means of a camera than with pencil or brush. As the objects to be recorded do not move, exposures may be prolonged to any necessary length; and a commencement can be made with almost any camera and an inexpensive lens. Later, no doubt, the photographer will feel the need for better equipment, and will then know in what direction to expend his money to the best advantage.

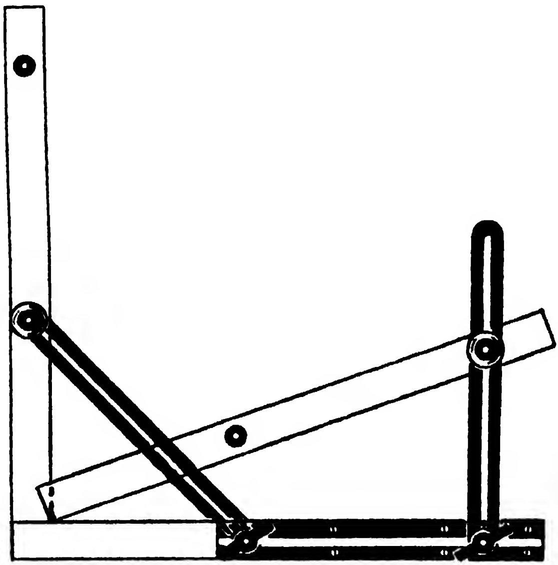
Some readers of this book may incline to take up architectural photography, and yet not know where to begin; but this, to my mind, is putting the cart before the horse. A lover of old buildings will naturally use photography to secure records of those he visits, and the problem before a thorough student may be how to limit his exposures on a building,

rather than how to hunt up subjects for the camera. There are many useful handbooks on architecture available for the beginner nowadays. Amongst the classics Parker's "Introduction to the study of Gothic Architecture" can be recommended; whilst for a more comprehensive text-book there is Rickman's "Gothic Architecture." It may be well, at the start, to circumscribe one's activities; this can be done by confining attention more or less to one architectural period, or by working within the limits of a single county.

I have already stated that simple apparatus will suffice for a start: an ordinary half-plate field camera fitted with an 8-inch rectilinear lens (or, better still, an anastigmat) is satisfactory. It should extend to about 16 inches, but so-called "triple extension" is not desirable, as the camera is less rigid. A rising front is essential, and there should be a swing back to the camera also. A turn-table in the base is not to be recommended. A rapid lens is not required in the great majority of cases, as an aperture of $f/8$ allows ample scope; only on photographing inside buildings, or for telephotography, will the need for greater rapidity be experienced.

The most suitable tripod is the old-fashioned two-fold wooden one, with sliding legs; the three-fold stands are more convenient for packing in a travelling kit, but they are not so rigid, nor will they work so near the ground as the former. As a supplement to the tripod the photographer should make for himself a rest to lie on the floor to prevent the tripod legs from slipping on a smooth pavement. This rest is made of three strips of wood, 22 inches

long, 1½ inches wide and ¼ inch thick. Three-ply wood from an old tea-chest is good material. At one end of each strip six holes, 2 inches apart, are bored through the wood, whilst at the other end a bolt with a fly-nut is put through to hold the three strips together. The rest is spread star-wise on the floor, and the ends of the tripod are put through the



A good form of Tilting-table, showing two positions, brasswork in black

holes, which should be large enough to allow the points to reach the floor. When the tripod top has been levelled, the fly-nut on the rest is screwed down and the camera will then stand firm, no matter how smooth the floor may be.

A tilting-table is an exceedingly useful, if not an absolutely essential part of the outfit. It should

be the same width as the base of the camera in order that the brass stays may project upwards; if they extend below the base of the table they get mixed up with the tripod, and interfere with the ease of manipulation. The best form of tilting-table is shown in the accompanying figure, which is sketched to show two positions, *viz.*, set at right angles for photographing the floor or roof, and at a smaller angle for such work as capitals of columns, or detail in the under side of an arch. A tilting-table is a piece of apparatus that is seldom seen in a photographer's outfit; a man will try perilous manipulations with the tripod, running risks of vibration and of collapse and breakage, to secure a record of an awkwardly placed subject which is child's play to the possessor of this useful adjunct to the camera. Ball-and-socket heads are pretty in theory, but for a camera of moderate size they are unreliable in practice.

A spirit level of fair size, say three or four inches long, is an aid to good work. I prefer one set in an L-shaped frame, for with this pattern it is easy not only to level the tripod top, but to ascertain whether the camera back is perpendicular or not; though a string and a bunch of keys, or a watch and chain, will serve for the latter purpose. A combination of string and spirit-level, using the latter for the plummet, is another alternative that I have employed with success. The small spirit levels attached to some cameras, and the little brass indicators to show if the back is plumb, are too small for critical work.

It is well to have plenty of plates available. Six double backs are generally ample, as if a dozen

exposures are made in the morning it is generally possible to arrange a dark-room for a change of plates at middle day. Some may prefer to take a changing-bag with them on an outing, but it is rather awkward work emptying and re-loading slides in such confined space. It is better to accustom oneself to load and unload double backs in a room absolutely dark. If this cannot be arranged in the daytime a bed will serve for a changing-bag.

A few photographers seek to economise material by making two, four or more exposures on equivalent portions of the plate. This can be done by placing a thin screen of black card between the reversing back and the frame of the camera. For two exposures this screen covers one half of the plate whilst the negative is taken on the other, and the position of the card is reversed for the next exposure. Four exposures can be arranged with equal facility by using a square card with one corner cut out so as to leave one quarter of the camera back open; this card is turned 90° after each exposure. There are more complicated systems, demanding the use of two or more cards, which enable further sub-divisions of the plate to be made, but they are not useful for our purpose. Occasionally the two-exposure dodge can be recommended for narrow strips of detail, such as a string-course in a building; but generally speaking it is far better to employ the whole of the plate on one subject only. To get the best results by subdivision it is necessary to be able to place the lens opposite the centre of the portion of the plate which is to receive the exposure, and this is impossible with stock patterns of cameras.

Another way of effecting economies in plates is to carry a changing-box or a film-pack adapter of ¼-plate size, adjusted to fit the larger camera. This is a very serviceable plan, particularly for a one-lens outfit, but for a photographer who has a number of lenses, perhaps including a telephoto, it is possible—and generally preferable—to fit the picture to the full size plate which the camera will take.

Should the addition of another lens for the outfit be contemplated, one of three-quarters the focal length of the general purpose lens, or, for a ½-plate camera, of 6 inches focal length, is convenient. It is more important to have a large working aperture in this lens, because it will be employed in tight corners where the 8-inch lens will not get in the whole of the subject, and for interiors where the light is more feeble. Lenses working af $f/6 \cdot 3$ are available in great variety; but if the purse permits the purchase of an anastigmat working at $f/5 \cdot 6$, or even $f/4 \cdot 5$ it may be worth while to incur the extra expense.

No architectural photographer's outfit is complete without a telephoto lens, and the rapid 6-inch anastigmat fitted with a 3-inch or 4-inch negative attachment will provide this tool. It will be valuable for detail work on the exteriors of buildings, whilst if the $f/4 \cdot 5$ lens has been selected, telephotographs may be attempted, under favourable lighting conditions, indoors also. A 12-inch lens is often useful for photographing details on a building; half of the 6-inch lens, when it is of separable form, can be employed, or an inexpensive $f/8$ rectilinear lens may be purchased.

There are three methods of calculating what exposure an object will require. Perhaps it is hardly true, however, to class estimation by the eye as a "method," so I will say two. The first is to use some form of slide-rule or scale. There are a number of these available, founded on the Actinograph invented by Hurter and Driffield. With these scales the photographer merely sets the instrument to a number representing the value of the light at the time of day of any given month, allows for the speed of the plate and the type of subject, and the correct exposure is worked out automatically. It will, however, be found that large variations in the actinic value of the light are brought about by the surroundings of an object to be photographed concerning which the slide-rule will reveal nothing. On this account an exposure meter, which takes the value of the light actually falling on the object, is more reliable; this is the second method alluded to above. With meters, an estimation of the value of the light is obtained by timing the discoloration of a narrow strip of specially prepared bromide paper. Most exposure meters are fitted with scales to simplify the calculation of exposures, but these are not essential.

Except in the case of interiors, where saving of time may be of importance, a slow plate should be chosen; it is not only easier to develop, but is really better for the particular work. A plate with a fine grain will bear enlargement best, and to a considerable extent a fine grain and low rapidity are linked characteristics. Isochromatic plates, or, now that they can be desensitized and developed by candle-light, panchromatic plates, are more

universally useful than ordinary plates with their low sensitiveness to reds and browns. Colour-sensitive plates are needed whenever colour contrasts occur in the subjects; as, for example, when red brick or tiles are in juxtaposition with stone. It is well to bear in mind that in most cases a properly adjusted screen, or light-filter, is necessary if the rendering is to be better than that an ordinary plate will give. This statement applies also to so-called "screened" plates. For dark-brown woodwork the superior sensitiveness of a panchromatic plate to reds is of great assistance; and for this work, and any other where the subject is practically in monochrome, no screen is required.

Before drifting into the subject of light-filters I should have said a word or two about backed plates. For interiors where windows may have to be included in the view it is desirable to have backed plates in the slides; so it is best, perhaps, to put up with the mess, and only use plates so treated; but in at least nine cases out of ten the advantages of this precaution are *nil*.

There is no better way of gathering experience than by spending a day in photographing a small building; if you can secure the company of an expert friend, so much the better. I remember well a day spent at Dunstable Priory with two other enthusiasts—one the editor of these pages, the other Mr. H. W. Bennett. The chief lesson for me there was the advantage of the non-slipping tripod rest already described. Mr. Bennett used one; I did not. He obtained a photograph which was duly hung on the walls of both the Salon and the R. P. S. Exhibition. His camera was firm as a rock; my

tripod "spread-eagled," and the camera came to grief. Before the sad accident, however, I had secured a series of photographs showing the whole of the front, details of the two rows of arcading above the entrance doorway, the doorway itself, and a large-scale photograph of an elaborate form of dog's-tooth moulding which was employed on the building. This old church has been restored since, and I do not know what appearance it presents to-day, but then it was remarkable for its combination of styles.

Among buildings that would well repay a photographer for a day or more spent on them, mention may be made of Adel, two miles from Horsforth station, near Leeds; Barfreston, one and a half miles from Shepherdswell station, near Dover; Kilpeck (St. Devereux station) in Herefordshire; and St. Peters in the East, at Northampton. All these churches are small; and for that reason they are not difficult to tackle; but each offers problems to the aspirant. The capitals on the chancel arch at Adel, the wheel window at Barfreston, the windows and corbels of Kilpeck, and the capitals of the columns inside St. Peters, Northampton, will tax his skill.

Perhaps the most important rule in architectural photography is this: the back of the camera should be vertical. If this is not the case, perpendicular lines in the building will be represented by diverging lines in the print. I have written "should" rather than "must," because there are apparent exceptions to the rule which will crop up later. The corresponding rule, that the back of the camera should be parallel to the face of the building that is being

photographed, is not only disregarded, but persistently broken by most photographers, as well as by draughtsmen. Why the skew view and diverging lines should be looked upon with disfavour in one case, and considered pictorial in the other, I am not prepared to say. Personally, my preference is for a doorway showing equal, or nearly equal sides; but if the splay view is sought, at any rate it should be obtained with the 12-inch rather than the 6-inch lens on the half-plate.

Quite early in his career the photographer is sure to come across a tall building that cannot be included on the plate without tipping the camera. However much the lens is raised, the top of a tower or spire is out of the picture so long as the camera is level and the back vertical. To deal with such a case it is best to raise the lens as much as possible within the limits of its covering capacity; that is to say, there must be no dark corners visible at the bottom of the screen, which represents the top of the photograph. Now obtain what further rise is necessary by tipping the camera. This will throw the focussing screen out of the vertical, and the back will need to be swung until it is once more perfectly upright. At this juncture the whole of the subject will be on the plate, and evenly illuminated; but sharp definition will be confined to a limited strip running across the screen. After focussing the camera so that the strip of maximum sharpness is near the middle of the plate, the lens should be stopped down until the whole image is sharp. Some photographers hold that it is undesirable to stop down more than is absolutely necessary; but for outside architecture, whenever the duration of

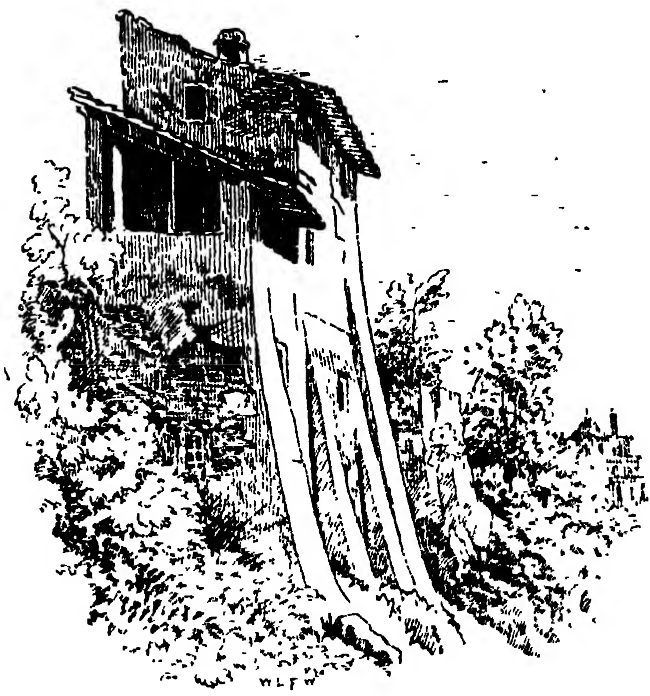
exposure is not of importance, there is no harm, and probably greater certainty of good, in the use of the smallest available stop.

Another way of dealing with a tall building is sometimes possible; that is, to set up the camera in a house opposite; if by this means it is possible to get the camera opposite the centre of the subject the work is simplified. For detail work, taken with a long focus or a telephoto lens, this plan should be utilized, as it offers great advantages; but a general view of a building taken from above the level of the street bears an odd unaccustomed appearance, which is better avoided if possible.

In the ordinary run of work we are photographing perpendicular planes, and the camera back on this account should be vertical; but if our attention is concentrated on either the floor or the ceiling, obviously the screen should be level (horizontal). The use of a tilting-table also brings intermediate conditions into play, when the camera back should be so arranged that it is parallel to the plane of the subject. Abnormal conditions arise in the case of telephotography, however, and the telephotographer must not rely implicitly on plummet or spirit-level, but rather adjust the swing-back of his camera so that parallel lines in the subject are parallel upon the ground-glass.

Development is fully dealt with elsewhere in this volume, but before closing this chapter I may point out the advantage of water and patience in the case of negatives of interiors. Such subjects very often cover a wide range of tones, and are more liable than exteriors to receive unduly short exposures. If this is likely to be the case it is well

to pour off the developer when the high-light detail appears, and pour on the same quantity of water, in which the plate may rest (without rocking) for a couple of minutes before the process is reversed and the developer re-applied. Warm water, say at 75° Fahrenheit, is more efficacious than cold, but if a higher temperature is employed there is a grave danger of melting the gelatine film. Warm water should not be used in the case of celluloid films.



THE MAKING OF LANTERN SLIDES

By

JAMES SHAW, F.R.P.S.

(There is no one better qualified than Mr. Jas. Shaw to advise on the production of perfect slides. He is himself a past-master of the art, and his advice is therefore of special value).

OF photographic positives, the most charming and beautiful of all is the transparency or the lantern slide. Why many of our leading pictorialists neglect this fascinating side of photography is a mystery. The old idea that the lantern slide could not be used as a means of pictorial expression has long been exploded, for broader views prevail to-day. Why such an idea ever prevailed at all is beyond my comprehension, for I have seen scores of exquisite slides, deliciously beautiful, and of perfect gradations, that of themselves completely settled the question whether they were pictorial or not.

It is possible to do all on the lantern slide that can be done on paper, and more. The glorious splendour of the skies, the fascinating brilliance of sunshine on broken foamy water, the delicate gradations impalpably melting into one another of exquisite mist effects, the crumbling effect of Old Father Time's hand on ancient architecture,

the broad gleams of sunlight sweeping across some woodland glade; all are rendered in the most perfectly ordered subtle modulations by a fine transparency as they never will be rendered on paper.

But great skill goes to the making of a fine lantern slide, and this is in itself an excellent thing, for it is all for the good of photography that perfection of technique should be maintained.

It is essential that a good lantern plate should possess the following qualities:—A transparency so fine that the image will appear almost like a stain; facility in giving good and varied colour; latitude in exposure; absolute freedom from annoying faults; a hard gelatine that will stand the heat of the projecting illuminant; and last, but not least, the power of rendering a range of tone from absolute transparency to almost complete opacity, in the subtlest and most perfectly modulated gradations.

Before a lantern slide can be made a negative is required, and it is only possible to make an excellent slide from a negative that is perfectly suited to the purpose. Brilliancy, tone, transparency and perfectly ordered gradation depend largely on the negative. In my own practice I like the type of negative that prints well in cold-bath platinotype. Such a negative possesses a long scale of gradation, not too dense in the high-lights nor too transparent in the shadows.

Systematize the production of your negatives, use a non-staining developer, and adopt time development, and then it will be quite easy to produce negatives eminently suitable for slide making. Most beginners over-develop their negatives, with

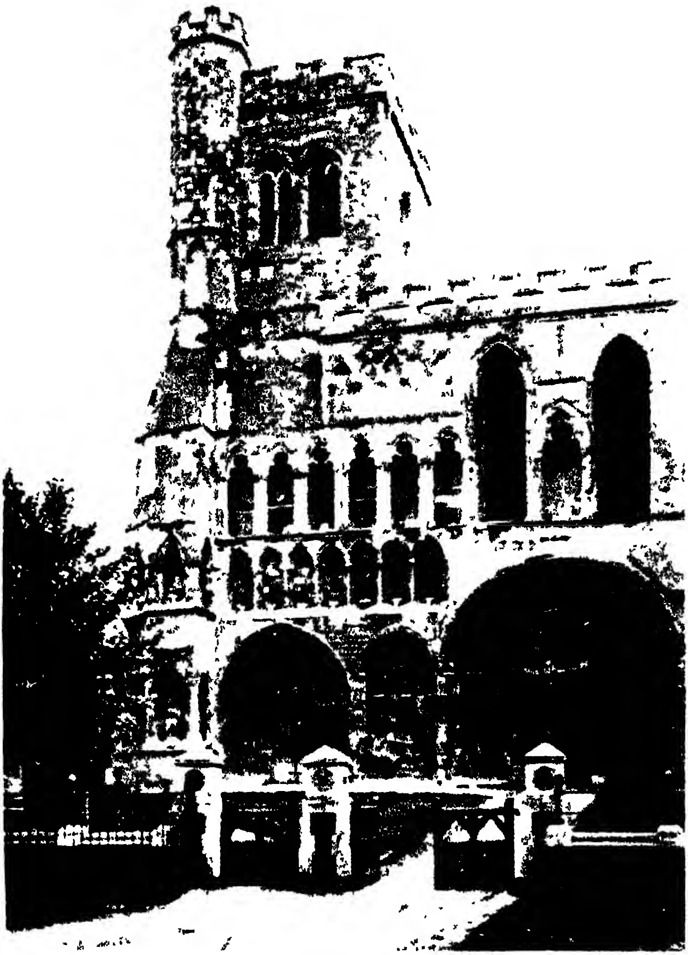
the result that when they attempt to make a lantern slide from them the result is crude and harsh and highly objectionable in every way.

Before proceeding to make the slide the negative must be closely examined and all defects eliminated, for, remember, the slide is for projection, and every fault will be enormously magnified on the screen.

There are two methods used in making lantern slides. One is by contact, and the other is by reduction in the camera or enlarging lantern. The latter is only necessary where the negative is larger than the lantern plate, *viz.*, $3\frac{1}{4} \times 3\frac{1}{4}$

The contact method is simplicity itself Place the negative, after being *well dusted*, in one of the many excellent slide-making frames, which allow you perfectly to adjust the exact position of the negative required, then place a *well dusted* lantern plate on the top of the negative, close the back of the frame, and expose for a few seconds to either magnesium, gas or electric light, develop, fix, and the slide is done. In my own practice I use a 50-c p. Osram electric lamp, and almost always expose from a fixed distance of 18 inches.

On the whole, there can be no doubt that the best method of making lantern slides is by the reduction method. A greater selective power is in the hands of the worker, any portion of the negative may be enlarged or reduced, it is easier to shade any part of the negative whilst exposure is going on, and, theoretically, the slide is sharper than one made by contact. The best illuminant is daylight itself. Daylight reducing apparatus can be bought ready made and at small cost. But it is not every worker who can get the time to work in daylight, and so



Dunstable Priory

J. Morris

fortunately the enlarging lantern can be pressed into service and reduced slides made during the evening, provided the lantern has a long extension. Use as powerful an illuminant as possible and then a slow lantern plate can be used and rich warm tones easily obtained The light I use comes from a Nernst 700-c p lamp, and I simply project the image direct on to the lantern plate, just as I would on to bromide paper. Care must be taken to see that the condenser is evenly illuminated. Thus local exposure can be resorted to if necessary quite easily, clouds can be put on the same plate as the landscape, and enlarged details of any part of a negative can be projected on to the lantern plate with the greatest ease. When using this method of production, the lantern plate must be backed and the transparent edges of the negative carefully blacked No extraneous light must filter through, for this has a knack of spreading on the surface of the lantern plate, causing fog

Exposure is always a problem to the beginner and somewhat of a mystery to the expert. The contrast or flatness of the negative, the strength of developer to be used, the colour of tone required, the scale of gradation for the subject, are all points that must be taken into consideration before determining what the exposure is to be The simplest way to surmount the difficulty is by trial and error. Expose the lantern plate in four sections, giving, say, 5, 10, 20 and 40 seconds, develop at 60° and let the plate develop as far as it will. Then fix and rinse and compare the four exposures with a test slide of good quality, and it should then be quite easy to determine the correct exposure.

There are as many developers for lantern slides as there are days in the year, but none is more suitable than the Barnet Formula given below.

	No. 1		
Hydrokinone	640 grains	or	25 grams
Soda sulphite	8 ozs		140 ,,
Potassium bromide	120 grs		4·5 ,,
Citric acid ...	240 grs		9·0 ,,
Water ...	80 ozs		1000 c cs.
	No 2		
Sodium hydrate	640 grs		25 grams.
Water ...	8 ozs		1000 c cs.

Both solutions should be carefully made up with distilled water and may be bought properly compounded from any good dealer. Take two drams of each solution to six drams of water, and if warmer tones are desired add 10, 20, 30, 40 and so on minims of a 10 per cent. solution of potassium bromide to secure tones so warm that ultimately a brick red can be secured. With this developer tones ranging from warm black through the richest browns to a brick red can be easily obtained by simply increasing the exposure and varying the amount of bromide.

I have no trouble in securing varying gradations from the highest lights—almost clear glass, but never quite—to the deepest, richest shadows following one another so closely and delicately that the beautiful softness so characteristic of an extremely fine slide is obtained without harshness, without crudity of tone, and without the loss of fine shadow transparency. I always make a strong point of transparency in the shadows in the perfect slide. It is absolutely necessary to secure that final touch to harmonious gradation which puts the slide that has got it right away into the highest class. Strange to say, many workers fail to produce soft and

gently graded slides with the weak hydrokinone developer given above, and so I offer here a further modification that has been eminently successful in my hands in getting very soft slides of a beautiful quality and tone. I like to get a soft, rich brown-black tone on my slides with ease and certainty, and so I thought I would mix developer as an artist would mix colours to give him the colour he desired. The hydrokinone developer as given above used with 60 minims of a ten per cent. potassium bromide solution gives a rich warm brown tone—provided a good negative has been used—and a fairly vigorous image. Rodinal, which gives detail first and density after, is an excellent developer for softness and a black tone, and when used sparingly with the hydrokinone developer produced an ideal developer for the production of an exquisitely softly graded positive of a rich brown-black tone of great beauty. Rodinal seems to mix perfectly with the hydrokinone developer and though, of course, there is a slight difference of tone in slides that have had varied exposures, because of the softness or harshness of the negatives used, yet the difference is so slight that I may reasonably maintain the combined developer gives a fairly constant brown-black tone. The following formula is the one I generally use.

No. 1 Hydrokinone	120 minims	24 c cs.
No. 2 ,,	120	24 c cs
Concentrated rodinal	5	1 c cs.
10 per cent. potassium bromide	60 ,,	12 c cs.
Water	1 oz.	100 c cs.

Temperature 60°. Time of development, 2 to 2½ minutes.

The chief characteristics of the above developer are reduced exposure, speedier development, rich

colour and a fine softness of gradation. This combined developer is also very suitable for the production of lantern slides when clouds are made on the cover glass and bound up with the landscape slide, for the colours usually are so nearly alike that the difference is scarcely noticeable. As a rule it is difficult to make the cloud and landscape slides alike in tone.

And now I will further extend my remarks on the production of warm toned lantern slides. Often have I been asked at the close of one of my lantern lectures "How do you get such browns and sepias in your slides?" The mere fact of the question being put to me shows a profound dissatisfaction with a black tone. And yet a really fine slide of a warm black tone is not to be despised. Most beginners manage to get a rusty cold black repellant colour and one can easily understand why they are apt to exalt the warm-toned slide altogether too much above its colder brother.

Certainly a warm colour is better liked than a cold colour, and it must be admitted that warm-toned slides suit the majority of subjects.

The mysterious element, called quality, that goes far in the making of a pictorial slide, is more easily obtained in a warm-toned slide. Again, transparency and great delicacy, the result of long exposure and restrained development, are usually present in the warm-toned slide. The image produced is almost like a stain, and the deep shadows are so translucent that print may easily be read through them.

Many workers advise the use of both ammonium bromide and ammonium carbonate to obtain rich,

warm tones, and it is undoubtedly an easy way to secure rich colour. Personally I never use either salt, for the following reasons. Shadows are more easily clogged up, density is extremely difficult to judge, and it is quite impossible to judge an ammonium slide by transmitted light, because of the creamy yellow deposit on the slide. I must confess that I get quite as much pleasure out of viewing my slides as exquisite miniatures as I do from seeing them projected on the screen. And so I firmly advocate the disuse of the ammonium salts. If ammonium is used at all then factorial development should be adopted, for exposure and development must be exactly suited to each other. You can get all the range of tones worth having with the two excellent developers I have given by simply suiting exposure to development. The longer the exposure given, the more potassium bromide there is in the developer—within reason, of course—and the warmer will be the resulting tone. The image will be of the tenderest delicacy, stain-like in quality, perfectly clear and transparent, even in the deepest shadows, and the slide should project practically as fine as it looks when held in the hand and viewed as a miniature by transmitted light.

The range of colour that I desire can usually be obtained by exposing the negative to the same light and from the same distance, in a ratio of one to eight, that is, if ten seconds gives a good warm black tone, then eighty seconds will give the warmest tone I want. The developer must be modified to suit the exposure and this is obviously a matter of experiment for each individual worker.

A crucial point is to know when to stop develop-

ment. Correct density in a slide is all-important, and let me say at once here that this problem is much easier to solve when there is plenty of good safe light to work by, so don't be sparing of dark-room light. I strongly advise making slides in series of one tone at a time. It is a mistake to make red, brown and black-tone slides together, for all three tones require judging differently for correct density. Warm-toned slides must be apparently denser than black-toned slides for they lose more in fixation. Very warm-toned slides, however, often dry denser and so allowance must be made for this when deciding when to fix. It is certainly more difficult to know when to fix a warm-toned slide than it is for a black-toned slide. If a uniform series of warm-toned slides are desired, then factorial development is a sure solution of the difficulty. In my opinion the only safe way of judging when the correct density of a slide is reached during development is by looking through it. Do not be alarmed if the high-lights veil over as the plate lies in the developing dish, for no really fine pictorial slide ever had clear glass in it. Clear glass represents nothing and even the sunlit edge of a cumulus cloud, the whitest thing in nature, has plenty of texture and detail in it, and this cannot be rendered by clear glass. The high-lights of a picture contain some of the most exquisite and delicate passages of light and shade, and the highest of these should be represented by the faintest possible deposit on the plate.

And so don't be afraid of a plate veiling before fixation. Often such a plate will fix out and show a picture of the softest and most delicate gradation

and of beautiful quality. Use plenty of brilliant safe light, get into the knack of judging density by looking through the plate, never make a second slide until you have compared the first with a good standard slide, and you will overcome the difficulty of judging correct density.

After development comes fixation. The lantern pl[illegible]te is rinsed under the running tap and then p[illegible]d in an acid fixing bath as follows :—

[illegible]	4 ozs	or	100 grams.
[illegible]m metabisulphite .	½ oz		12 5 ,,
Water	20 ozs		500 c cs.

U[illegible]esh fixing bath for every batch of slides. Fi[illegible]n is complete in a few minutes. The slide sh[illegible] washed in several changes of water a[illegible]dened in an alum bath. Formerly I [illegible] use an alum bath at all, but in these d[illegible] arc lights and powerful limelights [illegible]ad many slides completely wasted or melted in [illegible] of the fact that they had been thoroughly dried and made hot before binding up The alum bat[illegible]s not always prevent roasting or melting, but it [illegible]ertainly minimises the trouble to a great extent After fixation the slide should be carefully exa[illegible]ned and any modifications decided upon th[illegible]re and then. If too thin then it can be intensified w[illegible]th any of the well-known intensifiers, but a better [illegible]n is to remake the slide. I sometimes make use of the mercury bichloride intensifier when making lantern slides of snow subjects. Redeveloping the bleached and well-washed slide with ferrous oxalate developer not only produces a lovely bluish-black tone, but the slight veiling which also takes place imparts such a sense of atmosphere that the results

obtained are often magnificent. As a rule it is wiser to use the too thin slide as a cover glass. If the slide is too dense, then it can be reduced by means of the well-known Howard Farmer reducer. The formula is as follows :—

No. 1.	Sodium hyposulphite	½ oz.	or	10 grams.
	Water	5 ozs		100 c.cs.
No. 2.	Saturated solution of potassium ferricyanide.			

Take two ozs. of No. 1 and ten drops of No. 2. Immerse the slide in the solution and as soon as reduction is complete slightly rinse and fix again. Before using this reducer it is as well to wash the slide for at least 15 minutes after fixation, otherwise a yellow stain may be produced.

In my own work I make great use of this reducer. There are very few slides that cannot be improved by local treatment and so I invariably slightly over-develop and use the above reducer locally by means of a pledget of cotton wool. High-lights may be brightened and shadows thus deepened by contrast ; veiled and faulty skies can be cleared away in a delightful manner. Concentration of light and shade is rendered quite simple, and so Farmer's reducer is a wonderful friend to the manipulative worker.

The wise worker will, when locally reducing, work near a running tap so that the slide can, if necessary, be flooded instantly with water. It is amazing how soon the delicate tones in a high-light can disappear under "Farmer." The average worker will make the greatest use of this wonderful friend when adding clouds to the lantern slide. There are two ways of printing in clouds ; the first is by printing them on the same lantern plate as the landscape, and the second is by printing them on a separate

lantern plate and using it as a cover glass. The first method is troublesome and awkward for many reasons. It is difficult to prevent the clouds from overlapping the landscape, correct exposure of both landscape and clouds is not easy to estimate, and so one often develops up faster than the other; local development is resorted to with the result that the colour of one part of the slide is different from the other.

On the whole the second method is the easiest and the one usually adopted. The only disadvantage this method has is that it is not easy to make the cloud slide and the landscape slide alike in colour. This is specially difficult when very warm tones are desired. By using the Rodinal-cum-Hydrokinone developer and thus making the slides of a brown-black tone, this difficulty is practically eliminated and the putting of a sky into a lantern slide becomes a surprisingly easy matter.

One or two points should be specially noted when making cloud slides. Do not try to get an exact fit. No harm will be done if the clouds sometimes lap over on to the landscape, and at any rate by skilful use of the reducer it is easy to blend them into a deep wood or use them to tone down a high-light that is not wanted Don't forget that the lighting will be reversed when using a cloud slide as a cover glass, and so when selecting the cloud negative bear this point in mind. Lastly, don't over-develop your clouds. This is the commonest fault with most beginners. The cloud slide should be exposed and developed so that a light, delicate slide is produced. When both landscape and sky slides are developed and fixed, place them back to

back, and then carefully blend them together by reducing away the veiled sky on the landscape slide, and the superfluous clouds on the sky line, using a camel-hair brush charged with the Howard Farmer reducer. After reduction the two plates must not only be well washed, but also hardened in an alum bath, for experience teaches me that slides which have been reduced with "Howard Farmer" are more susceptible to melting in the lantern than those that have not been so reduced. After well washing again the two slides are thoroughly dried and bound up together.

Nothing is more wearisome to the average audience than to see slide after slide appearing of a uniform black and white during the course of a long lantern lecture. A lecture set made up of a series of slides of various tones is far more pleasing and affords welcome relief to the eye. In years gone by there were few toning methods available to the average worker; to-day the number of excellent toning formulæ is legion. Personally, I must confess that I like to get most of the tones I admire by development pure and simple, and as far as warm tones in particular are concerned I am quite convinced that the best, purest and most transparent tones are obtained in the usual way by long exposure and restrained development. In this way a delicacy of image is produced, a fineness of grain attained, that no after-toning formulæ will equal.

Still there are many colours that are not easily obtained by development pure and simple, and one of these is a pure blue suitable for so-called moonlight effects and ice and snow pictures. The

easiest, surest and simplest way of obtaining this colour is by using the ordinary sulphocyanide toning bath.

Sulphocyanide of ammonium .	30 grs.	or	3·5 grams.
Gold chloride	4 grs.		·45 "
Distilled water	2 ozs.		100 c.cs.

Before toning, the slide must be thoroughly freed from hypo and dried. A slide that has been dried tones more regularly, though much more slowly. As soon as the desired depth of tone is reached take the slide out of the bath, thoroughly wash and dry. Slides toned in this bath retain their original transparency. I have already mentioned the use of the bichloride of mercury intensifying solution for producing both atmosphere and a true black tone suitable for mist, snow and winter effects. Slightly different shades of black may be obtained by using developers other than ferrous oxalate for redeveloping. As this method involves a slight increase of density, the slide to be toned should be a little too thin, but perfectly clear and transparent and quite free from veiling.

Warm brown tones are, of course, easily obtained by using the sulphide toning method, but this process in my hands rarely results in as satisfactory a tone as I can get by pure development, and invariably the image is much more granular and not so transparent. On the whole I strongly deprecate the use of the sulphide method for obtaining warm tones on lantern slides. The old method of obtaining warm tones by the use of uranium nitrate is rarely used now, though when used with a slide of a pure black tone a chocolate brown could be obtained that was very hard to beat. I have such

a toned slide by me now as perfect as the day it was made twenty years ago, and as beautiful as ever. The formula is as follows :—

No. 1

Uranium nitrate ...	... 40 grs.	} or {	2·5 grams.
Glacial acetic acid	... 20 minims		1·5 ,,
Water	... 4 ozs.		120 c.cs.

No. 2.

Potassium ferricyanide	... 40 grains	} or {	2·5 grams.
Water	... 4 ozs.		120 c.cs.

Mix before using and use a perfectly clean dish. The plate is put in the solution and the dish gently rocked. Toning takes place rapidly and the plate must be constantly examined. Remove the plate just before the desired colour is reached, for toning still goes on slightly—and then wash well in running water for a few minutes. Any yellow stain that still remains in the high-lights can be cleared by immersing the plate in a bath of

Sulphocyanide of ammonium	30 grs	2·0 grams
Water	2 ozs	60 c.cs.

Leave the plate in this solution until the yellow colour is discharged and then wash again for a few minutes in running water. Slides for uranium toning should be clear and thin, because the colour is obtained by the deposit of a uranium salt and this has an intensifying action. It is advisable to under-tone with uranium rather than over-tone, otherwise the image becomes dense and granular.

An infinite variety of colours may be obtained by using the "Diachrome" method, introduced by Dr. A. Traube.

Slides to be treated should be of a black tone. These are bleached in a solution of iodine in potassium iodide, then well washed and put to soak in a dye bath until the required depth of colour is

reached. The slide is then placed in a bath of weak acetic acid. This clears the high-lights and the slide is then well washed and dried

For the process a special series of dyes has been prepared by Messrs. Griffin & Sons. The results attained are very beautiful, though the final tone must always be judged on the screen. Whether they are as permanent as developed tones remains to be seen.

The slide having now been exposed, developed, reduced, skied and toned, nothing remains but to dry, mask and bind it up.

Presuming the slide has been thoroughly washed, the next step is to carefully clean its surface with a tuft of cotton wool whilst held under a running tap. It is astonishing how much dirt can get on the surface of a slide during washing, and to dry it coated thus is fatal to perfect transparency After being thoroughly cleansed in this manner the slides are placed in a metal rack and dried by heated air. This is simply done by suspending the slide rack some 3 ft. above a gas-ring burner that is just only slightly burning A current of warm air quickly ascends and in an hour the slides are dried and as far as is possible quite free from dust. When dry the slides should be carefully examined and all transparent spots, etc, spotted out. To do this thoroughly and yet not spot too densely—a common fault—the slide should be placed in a retouching desk, on a piece of etched glass like a fine focussing screen. Behind this glass place a 50-c.p. electric lamp. The intense light will quickly reveal whilst spotting whether too much colour is being laid on a spot, and thus the matching

of density becomes a matter of the greatest ease. The spotting colour must, of course, be matched with the colour of the slide, by daylight. Remember bad spotting shows up terribly on the screen. The slide after spotting must be masked, and here let me entreat the worker to eschew all round cornered masks. Why they are still used is one of those mysteries that seemingly will never be solved.

After masking, select a cover glass and be sure that the inevitable bubble is placed in some deep shadow where it will pass unnoticed. Before binding up make both cover glass and slide as hot as the hand will bear.

Gelatine is hygroscopic and the slightest moisture left in means a ruined slide the first time it is shown in the lantern.

The slide may now be bound up, and, last, but not least, the two white spots so essential to the comfort of the lanternist should be placed in the two top corners of the slide when looking at it in its natural position.

The slide is now made and finished, and if properly done is the most beautiful, delicate and entrancing positive picture that photography is capable of producing.

AN INTRODUCTION TO BROMOIL.

By

JAMES A. SINCLAIR, F.R.P.S.

(This is a simple and practical article to help the photographer to make his first experiments with a fascinating process)

HOW TO SUCCEED WITH BROMOIL.

BROMOIL is not difficuft, at least so far as its technical side is concerned *IF* the worker will take the trouble to understand sufficient of the theory to comprehend what he is doing, and knows beforehand exactly what he wants to do. Both these things are essential. Most of the difficulties that occur in making prints can be entirely obviated if the principles underlying the process are fully understood. This, of course, is so far as technique is concerned. No amount of theory will make a man an artist, it can only teach the artist to use his tools. Do not start a Bromoil thinking you are going to make a Bromoil print into a picture because of the process. You must see first of all the picture in your mind's eye, and know exactly to what extent the Bromide print requires modification before starting on the work.

WHAT IS A BROMOIL?

A Bromoil print is simply a Bromide print from which the silver has been removed and a pigment substituted for it. It is made by immersing the Bromide print in a chemical solution which bleaches

out the silver image and by this action affects the solubility of the gelatine in which the silver is embedded. The gelatine being in varying states of solubility absorbs water to a greater or less extent. In the high-lights of the picture, there being little or no silver, the bleaching solution has little or no effect and the gelatine in those parts absorbs a considerable quantity of water. In the deep blacks of the picture the bleacher renders the gelatine almost insoluble, and consequently Bromoil printers frequently speak about the "relief" of their pictures after bleaching, fixing and washing, the high-lights then standing up prominently above the other portions. A print that has been treated in this way has the power of absorbing a greasy pigment in an inverse degree to the way in which it absorbs water, provided the pigment is in proper condition and applied with a suitable brush. The high lights charged with water reject the pigment; the shadows, insoluble and not holding water, absorb the pigment when it is applied. It is very important always to remember this principle, because we can then understand that when a print will not receive pigment it is probably because there is too much water in it, or where it receives it all over, from some cause or another it has not absorbed enough water before pigmenting.

THE MATERIALS NECESSARY.

The necessities, apart from those most photographers have, are but few. They consist of brushes of the proper form and quality, one or two tubes of pigment (which may be obtained specially prepared for the process), some medium, which must be used only when absolutely necessary, a palette (a piece

of plate glass finely ground or matt opal is the best), palette knife, a bottle of bleacher, and some pieces of blotting board.

TYPE OF NEGATIVE.

For the Bromide print or enlargement use a negative perfectly clean and full of detail. It should not be solidly black in any portion, and for general guidance, a negative which when placed on printed matter enables the printing to be just discerned through the highest lights is quite suitable. Satisfactory Bromides for pigmenting may be made from other negatives, but these are rather for the expert than for the beginner.

THE BROMIDE PRINT.

For this purpose I prefer an ordinary cream crayon or rough surface paper (not platino-matt), but each worker after a little time finds what will suit his own handling best. "Barnet" papers are coated with gelatine that is not too hard, and are suited for both ordinary work and the transfer process. The print should be developed with Amidol and every gradation which is desired to be reproduced should be contained in it. After development it is fixed and washed in the usual manner and can, if desired, be bleached and pigmented immediately, although in my own practice I usually dry the print and do the bleaching on another occasion.

BLEACHING THE BROMIDE PRINT.

To bleach the print there are a number of proprietary articles sold, and a good many formulæ have been printed from time to time. I always use the Sinclair Bleacher, which is a proprietary article, but there are others, and possibly the one given by Mr.

Raymond Crowther, an experimenter who has investigated the process for some years, is as good as any other. He suggests:

Copper Sulphate crystals	10% solution	170 minims		or	10 c cs
Potassium Bromide ..	10%	,, 130	,,		8 c cs.
Chromic Acid crystals	1%	,, 45	,,		2.5 c.cs.
Water		to 3½ ozs			100 c.cs.

Immerse the dry Bromide print in water until limp and then place it in the bleaching bath until it is thoroughly bleached in the deep shadows. In winter or in cold weather the temperature may be raised to 70° or 75° F. After bleaching, well wash the print and then fix it in hypo solution:

Hyposulphite of Soda	.	1 part
Water .	..	10 parts

There has been some discussion as to whether this should be an acid bath or not. Mr. Raymond Crowther in recommending his bleacher suggests adding to the above fixing bath one grain per oz. of Metabisulphite of Potash. He states that a larger quantity of Metabisulphite may have some effect on the solubility of the gelatine of the bleached print. After fixing and washing the print may be pigmented. If the print is on a paper such as the "Barnet" it will probably not require any special temperature for the bleaching or washing waters, and 65° to 70° should be ample. If, however, the image does not appear to have any relief after bleaching, fixing and washing, the temperature of the final washing bath may be raised to 80°F. or even rather higher in the case of exceedingly hard gelatines. In order to see whether there is any relief on the print the surface must be slightly blotted off with a piece of butter muslin, or with an old clean linen handkerchief, which is very suitable for the purpose.

PIGMENTING.

We first want a pigmenting pad somewhat larger than the print we are working. A piece of plate glass does admirably, or a pulp squeegee board, or a plain drawing board covered with sheet zinc. On the top of our pigmenting board we place, say, four to six thicknesses of wet blotting boards, on the top of which an old linen handkerchief may be stretched with advantage, although this can be dispensed with if not within reach, and then on the top the wet print is placed and the surface carefully wiped or dabbed with a clean linen rag, so that all surplus water is removed. This is most important, for should a drop of water get on to the brush there will be a great deal of trouble. It is well to pass a roller squeegee over the blotting boards to force out any excess of moisture before placing the print upon them.

Now press from the tube on to the palette a little pigment, say, the size of a pea, and with the palette knife rub it down vigorously, using all the force of which you are capable, so that the pigment is spread in a very thin coat of almost dry colour. Tapping the brush on this attenuated film of colour will pick up a very small amount on the hairs, so little indeed that if the brush is wiped over the back of the hand the colour does not come off, and the hairs are not stuck together, but each hair seems to be as free as when starting to work. Most beginners make the mistake of getting too much ink on the brush; they cannot imagine that the trifle that is required can build up an image. After tapping the brush on the colour for, say, a dozen times, it is tapped on a dry part of the palette and if there is enough pigment on

the brush it will make a beautifully stippled bloom on this dry part of the palette. Should be pigment be a little too dry to do this then the merest shade, say, a pin's head of medium may be well worked into the colour on the palette, still keeping it very thin ; and the brush is again tapped on the thin pigment.

If we now start tapping the bleached image we shall probably find the gelatine begins to absorb the pigment and the image can be gradually built up. Some parts can be made very much stronger than in the original Bromide, and others either by not working on the surface, or, if the surface has been worked over, by a sharp quick jump of the brush, may be cleared of the colour. It must be remembered that a dragging action tends to put the colour on, and a quick sharp jerk to take it off. Many workers use a hopper, which is indeed a most useful adjunct, particularly when working clouds in skies or in strengthening contrast in some particular part of the print ; but at the start I should certainly recommend the beginner to learn to do without the hopper. If brush manipulation is properly studied the hopper becomes a valuable servant—if you start inking up with a hopper, as some people do, the hopper becomes your master and you cannot do without it, and for some types of Bromoil work this is particularly prejudicial, especially in the case of transfer work, because the hopper tends to force the pigment down into the gelatine, instead of it being entirely on the surface in an easily transferable state. It is well to try different styles of brush action. Some workers hold the brush almost at the end, and with the print on a slightly slanting desk gradually tap the brush from the top to the bottom of their

pictures, and this gentle type of action is of great use for delicate effects. Broader effects, however, will be obtained by holding the brush lower down and working with an action almost as if making a series of commas on the print. In the case of papers with hard gelatine considerable force may be needed, whereas softer gelatines take the pigment with avidity, as if they were really fond of it.

AFTER TREATMENT.

After pigmenting it will be found that possibly there are quite a large number of broken hairs on the print. The brush whose hairs do not break has not yet been invented. When the print is dry most of them are easily removable. An excellent tool for the purpose is one of the pen print-trimmers. This may be used for lifting the hairs from the surface, and should there be any mark of black pigment near a hair it can easily be scraped away with this print trimmer. The same little instrument will remove any other specks or blacks that may be in the print. When the print is nearly dry, rubbing on any portion with the ball of the finger will tone down a too obtrusive high light. Other lights may be touched up and strengthened by means of special finishing rubber, or in the case of wet prints they can be added with plastic rubber, or by means of oil stumps.

MOUNTING THE PRINT.

Some workers seem to be greatly troubled by the time prints take to dry, but my own experience is that with the pigments that I invariably use, mixed with a little Roberson's medium the print may be mounted certainly the day after it is made. Indeed, I have mounted it on the same day. I usually take

such a mountant as Johnson's, brush it with a stiff stencil brush over the back of the print, work it all over with my finger, lay the print on a piece of cardboard, place over the surface a sheet of oiled or waxed paper, and rub it down lightly, afterwards drying under slight pressure so that the cardboard does not cockle.

CARE OF THE BRUSHES.

In conclusion I would only say that if care has been taken to follow closely the directions here given, a Bromoil print will certainly result. It may not be exactly what the worker hopes to get, but if he know what he wants facility will come with practice, and he is certain to succeed. Having made his print he, however, would be well advised to take the greatest care of his brushes. They may be either cleaned with petrol, in which case an old rag is taken, some petrol is put on it, and this is wiped over the surface of the brush; or petrol being a decidedly inflammable and dangerous material a special solution known as Carbona does admirably for the same purpose. The beauty of these volatile compounds is that the brush is ready again for use after an hour or so. Another method is to clean the brushes with soap and water, and this is a plan adopted by many workers, but I cannot say I have ever tried it. I have used either petrol or Carbona ever since the process was introduced, and I have brushes many years old all in excellent condition. After cleaning they should be replaced in the little paper holders in which they are originally sent out, so that the hairs are all kept straight rather than splayed out as they are when working.

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Barnet Matt-Emulsion Plate

THE BARNET MATT-EMULSION Plate is one of those inventions which, like the idea of perforating postage stamps, originated in a happy thought Extremely simple in itself, but none the less of great and far reaching importance by reason of its commercial application and usefulness
Every Amateur and Professional Photographer will be interested in BARNET MATT EMULSION Plates

1 Because they give a higher standard of excellence
2 Because they are easier to use
3 Because they actually save money

What they are

BARNET MATT-EMULSION Plates are coated from specially treated emulsion, in which is incorporated a substance which produces a beautiful matt appearance on the finished negative, similar to the finest ground glass

Advantages

1 Entire freedom from Halation The Matt Film prevents back reflection, and therefore the old-fashioned backing which was messy and expensive, can be dispensed with

2 Negatives made upon Barnet MATT-EMULSION Plate give absolutely sharp definition both in contact prints and enlargements, and vastly improved printing quality

3 Barnet MATT EMULSION Plates are quicker than ordinary plates and certainly quicker than Roll Films It is a well known fact that rapid emulsions suffer the serious disadvantage of being reduced in speed after being coated upon Celuloid The Barnet MATT-EMULSION Process actually augments the speed

4 The surface of a Barnet MATT EMULSION Plate has a fine tooth which allows the use of a pencil A hard pencil is the best to use for this purpose

5 The extraordinary latitude of Barnet MATT-EMULSION is remarkable. There is far less risk of over or under exposure

6 Very beautiful transparencies can be made upon them A positive made upon a MATT EMULSION Plate requires no further backing up with ground glass

7. Barnet MATT EMULSION Plates are made in two grades —

Super-Speed Ortho 550 H & D
Self Screen Ortho 300 H & D.

correctly ortho-chromatized for general work. No light filter is required They are equally suitable for Landscape or Home Portraiture

8. No extra charge is made for Barnet MATT-EMULSION Plates.

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